PHYSIOLOGY HYGIENE AND SANITATION

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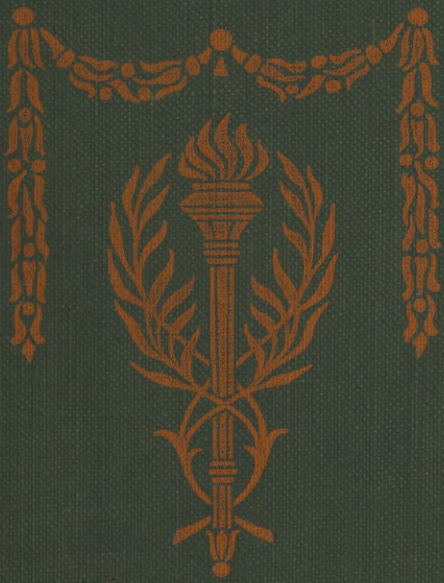

CUZZORT-TRASK HEALTH SERIES

ESSENTIALS OF PHYSIOLOGY · HYGIENE AND SANITATION

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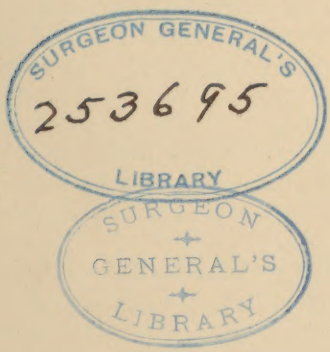

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CUZZORT-TRASK
HEALTH SERIES

Health Lessons
For pupils under eight

Primer of Personal Hygiene
For pupils from eight to ten

Health and Health Practices
For pupils over ten

Essentials of Physiology, Hygiene and Sanitation
For pupils over eleven

PREFACE

If we would have a healthy, physically efficient race, the individuals must live lives conducive to health and physical well being. They must have a desire to be healthy and realize that their well-being depends largely upon their habits of life and that their physical fitness is a matter largely within their own control.

The time to teach proper habits of living, "health habits," is in childhood. Healthy men and women are to be secured best, and perhaps only, by having the child develop "health habits" which become second nature. But such habits, if they are to be rationally followed, must be based upon an underlying knowledge of the human body and of its needs and of the agencies which impair health and produce disease.

It would seem reasonable to assume that there is nothing that can be taught to the boy and girl more important than how to keep well and strong, how to avoid disease, and how to prolong their lives. Such knowledge can not but make them happier, more efficient adults, and better citizens. An effort has been made in the text to discuss these things in such a way that the average boy and girl in the seventh and eighth grades will readily, and without particular concentration, understand; and understanding, will be filled with a desire to make and keep their bodies physically sound and fit.

An attempt has been made to present the essential facts of hygiene and sanitation in a manner so simple as to be easily within the grasp and interests of the growing boy and girl. Amplifying and fixing in the mind the matters treated should be accomplished by class work. The first eight chapters deal with such anatomy and physiology of the body as it is believed the boy and girl should know. The teacher should illustrate these chapters by class work, for which the text provides a guide.

The purpose of the author has been to keep the book as small as possible and at the same time tell what the pupil should know and what his mind can grasp. Many details which constitute useful knowledge and which are often included in similar books, but which are seldom grasped by the pupil so as to become a part of his store of knowledge, and which act rather to bury and conceal the more important facts, have been omitted. That only has been included which it is believed the average pupil between eleven and fourteen years of age can mentally assimilate so readily that it will become part of his permanent store of information.

JOHN W. TRASK.

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Shows a well developed body-machine

ESSENTIALS OF PHYSIOLOGY, HYGIENE, AND SANITATION

CHAPTER I

Our Bodies and What They Are

Our bodies are the houses in which we live. They are most wonderfully constructed. Our bodies as we see them consist of a head, a trunk, two arms, and two legs. By using our legs we can walk and run, by using our arms we can do many things. The trunk contains many important organs: a heart which pumps blood through our bodies, lungs by which we breathe, and a stomach and intestine which digest our food.

Our heads contain our brains, eyes, and ears. With our brains we think, reason, remember, and store up knowledge. With our eyes we see the world about us. With our ears we hear the many noises and sounds, the song of birds and the rumble of thunder — we hear each other talk.

Much of our success and happiness in life depends upon whether our bodies do their work well. If our brains cannot think and reason clearly, then we do not get along, we have trouble in school, and are likely to get into many difficulties. If our eyes do not see well, we miss many things. If our ears do not hear, we live in a noiseless world and do not have the pleasure of hearing people talk. If our hearts or lungs or stomachs are weakened,

we become invalids and are deprived of many of the joys of life. If we lose a leg or an arm, we are crippled.

When our homes burn down, as they sometimes do, or are destroyed by the wind, as happens in some places, we can build new ones. But with our bodies it is different. Each of us can have but one body, which must last us during all our lifetime. If it becomes crippled or diseased, then we must get along during the rest of our lives with a body which cannot do many things.

As our bodies are so important to us and have so great an influence on our lives, we will naturally want to make them just as good and strong as we can and will do everything to keep them in the best possible condition. Fortunately most of us can have good bodies if we want them and can keep them sound and useful if we really try.

The various parts of our bodies become strong and skillful by proper use. They become weak and smaller if not used. If we use our brains to think and reason and study, then our brains become better and better able to think and to reason and to study. Every time we reason out a difficult example in arithmetic, we exercise our brains and make them better able to reason. The trained eye sees more than the untrained eye. The woodsman sees many things in the forest that others do not. The trained ear will hear and understand sounds that the untrained ear misses. How many many things the hands and arms can be taught to do! How much more skillful some are than others! And even our legs and feet can be trained. The untrained legs and feet are clumsy and stumble. We think of the deer as graceful in running, and of the mountain goat as sure-footed, but by proper use and training we too can be graceful and sure-footed.

Training the various parts of our bodies to do their work well is a thing we should all aim to do, and this is what we do when we play and when we work. When we walk, run, or play games we are training our bodies. Baseball and tennis train the arms, legs, and bodies, so do tag, skating, and swimming, and the various outdoor games boys and girls play. We can train our bodies even while we walk to school. We can teach the muscles of the back and neck to hold the body straight and the head erect, and the lungs to breathe deeply. The best time to train our bodies is when we are young. It is much easier then than when we are older.

But even after we have trained our bodies we must make them do things because they will not keep fit and in good condition unless we do. Our legs and arms and bodies and brains must be used or they get out of order. Using our bodies is sometimes spoken of as getting exercise. Sometimes we call it play, sometimes work. The man who works outdoors all day will exercise his brain in the evening by study. Or the man who works in an office will walk or play golf or tennis or baseball to exercise his body and legs and arms.

To keep our bodies strong and fit we also must not let them get sick and diseased. Some diseases are due to eating improper food, some to improper habits. These we avoid by proper eating and living. Some diseases are due to what we call microbes or germs, and are got from others who are sick. We shall learn more about these later.

We shall first learn how the body is built up of bones and muscles and tissues and how it contains organs which work for us and what the organs do.

Questions

1. What are our bodies?
2. What do our bodies consist of?
3. Do we need good sound bodies? Why?
4. What happens if our eyes do not do their work well?
5. What happens if our ears do not do their work well?
6. What happens if our brains do not do their work well?
7. What happens if our heart or lungs or stomach becomes injured?
8. What happens if one loses a leg or an arm?
9. If our bodies become damaged can we get new ones? Why not?
10. Can we have good bodies if we want them? What do we need to do to have good bodies?
11. How can we make our bodies strong and better able to do things?
12. How do we make our brains able to think and reason better?
13. Can we make our eyes better able to do their work? Can we train our ears? Our arms? Our legs?
14. Why do we want trained bodies that are able to do things well?
15. How does playing games train the body?
16. How can we train our bodies while we are walking?
17. When can the body be best trained to do things, when we are young or when we are older? Why do you think this is so?
18. What happens if we do not use our bodies? What would happen if we did not use our arms for a long time?
19. What do people mean by "getting exercise"?
20. What may sickness and disease do to our bodies?

CHAPTER II

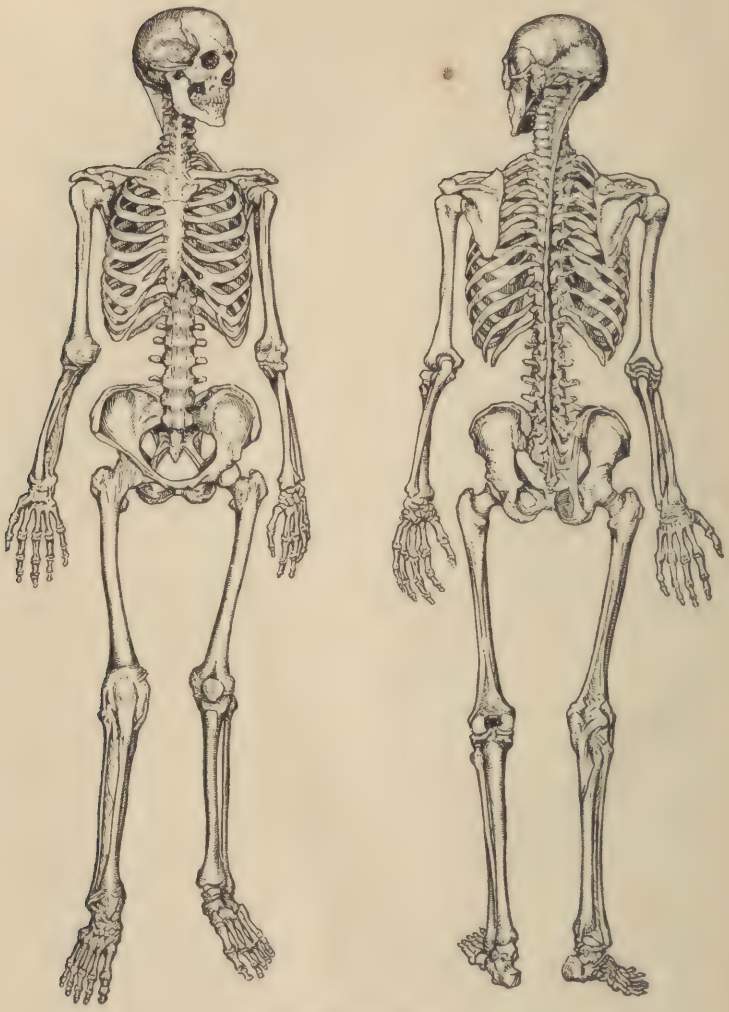
The Bones and Their Purpose

Each of us has in his body over 200 bones. These are so joined together that they support the body, and make it possible for us to stand straight, and to walk about. The bones are fastened to each other in such a way that they form a framework to which softer parts of the body, such as the muscles, are attached. This bony framework is called the *skeleton*. It is the skeleton which makes it possible for us to stand upright. If we had no bones, our bodies would be much like large jellyfish or oysters.

Some bones are long and slender, some are small like marbles, some are thin and flat. Their shape depends upon where they are in the body and what they have to do. Long bones are found in the arms and legs. Short round bones are found in the wrist and in the foot. Flat bones are found in the head, where they form a box to protect the brain. There are also bones which are very irregular in shape. Some of these are found in the face and other parts of the head.

Bones are hard on the outside and usually softer inside. The long bones are hollow like a pipe. The hollow part is filled with soft material called *marrow*. The inside of some bones is like a honeycomb. The little spaces have walls of bone and are filled also with marrow.

Bones are hard because they contain lime, just as the oyster shell which is made of lime is hard. But running

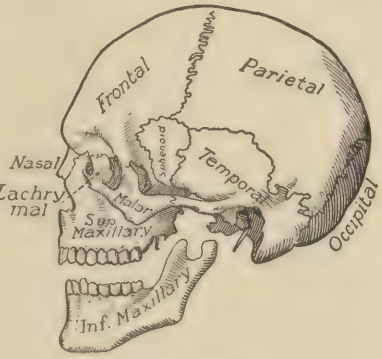


THE SKELETON

Showing the bones of the body, front and back.

all through the hard part of bones are small canals which contain little blood vessels and nerves.

The Skull. — The bones of the head are called the skull. The skull is made up of 22 bones. Eight of these bones are so fastened together that they form a box. Inside of this box is the *brain*. The bony box protects the brain from harm. Fourteen of the bones of the head are in the face and give it its shape. All of the bones in the head except one are fastened together so that they do not move. This one bone is the lower jaw. It is fastened to the skull in such a way that it moves as though it were held by a hinge. By moving this bone up and down on its hinge we can chew our food and open and close our mouths. The skull rests upon and is supported by the backbone or spinal column.



THE SKULL
Showing the bones of the head.

The Spinal Column. — The spinal column is sometimes called the backbone, because it extends down the middle of the back. It is made up of 33 irregularly shaped bones called *vertebræ*. They are so joined together that each vertebra will move a little on the one above it and the one below it. The 33 bones taken together make the spinal column, which is about two feet long in an adult. While each vertebra will bend just a little on the one next to it, the whole spinal column will bend a good deal, as it

does when we stoop over and pick up something from the ground, or when we bend our bodies sidewise or backwards.

THE BACK BONE
Or spinal column, showing how it is made up of many bones called vertebræ. Notice how it curves.

The upper seven vertebræ are in the neck. The next twelve have ribs attached to them. The five below these are in the small part of the back at the waist. In the adult the next five vertebræ grow together to form one bone called the *sacrum*, and the last four grow together and form one bone called the *coccyx*.

The spinal column forms a strong pillar which supports the head. The vertebræ are so shaped that there is formed at the back of the spinal column a bony tube in which is the *spinal cord*. This cord is an extension of the brain. From it large nerves extend out through openings between the vertebræ.

The Thorax or Chest. — The thorax or chest is a bony cage inside of which are the heart and lungs. The bony cage protects these important organs from harm. It is made up of the breast bone or *sternum* in front, the spinal column at the back and twelve ribs at each side. All the ribs are fastened to the spinal column at the back. The upper seven are fastened to the sternum or breast bone in front.

The ribs have spaces between them, but these spaces are filled in by muscles which extend from one rib to the next one. The ribs are so joined to the vertebræ behind

and the breast bone in front that they will move up and out when we breathe. This movement is shown when one takes a long breath and expands his chest.

The bony cage which makes the thorax opens at the top into the neck. At the bottom it is closed by a broad, flat muscle called the *diaphragm*. The diaphragm is used in breathing.

The Arm.—The bones of the arm consist of the *humerus*, which is the long bone extending from the shoulder to the elbow, and of the *radius* and *ulna*, two bones which extend from the elbow to the wrist. The part of the arm between the elbow and the wrist is usually called the forearm.

In the wrist are eight small bones so joined that they allow considerable movement, as will be seen by bending the wrist. Yet the eight bones are so fastened together that the wrist is very strong. The wrist bones are called the *carpal* bones.

Below the wrist bones and joined to them are five slender bones in the palm of the hand. They can be felt through the back of the hand. There is one for each finger and one for the thumb. They are called the *metacarpal* bones.

Fastened to the metacarpal bones are the bones of the thumb and fingers. The thumb has two bones and each of the fingers three. These bones are called the *phalanges*. They are so fastened together that we can move each on the one next to it just as if it was fastened by a hinge. This is shown when we double up our fists. We can place the tips of our thumbs against the tips of each of the four fingers. We can also grasp hold of things and hang on to them with our hands. Very few animals can do this. The monkey can.

The arm is attached to the body at the shoulder by what is called the shoulder girdle. This is made up on each side of the collar bone or *clavicle* in front and of the shoulder blade or *scapula* behind. The clavicle is a slender bone joined at its inner end to the top of the breast bone or sternum. At its outer end it is joined to the shoulder blade. It keeps the shoulder out and prevents its falling forward. The shoulder blade or scapula is a flat bone and can be felt on each side, at the upper part of the back behind the shoulders. It can be felt to move when one moves his shoulder. The arm is joined to the shoulder blade in such a way that the arm can be moved in all directions, as when one throws a ball.

The shoulder girdle, the arm, and the hand, all taken together, are called the upper extremity. The principal purpose of the upper extremity is to grasp and hold on to things. No animal has hands so well adapted to do this as our hands are.

The Pelvis. — The lower end of the spinal column or backbone fits in between and is supported by two large irregularly shaped flat bones. They are called the *ossa innominata* or pelvic bones or sometimes the hip bones. There is one on each side. They are joined behind to the sacrum. They curve out and come together in front where they are joined together. The cavity between these bones is called the pelvis. These are the bones that we feel at our hips. They are also the bones upon which we rest when we sit.

The Leg. — The part of the leg above the knee is known as the thigh. It has one long strong bone, the *femur*. The femur is the longest, largest, and strongest bone of the body. Except at the ends it is round like a broom handle.

It is hollow in the center, however, so that it is probably better to say it is cylindrical like a gas or water pipe. The upper end is joined to the pelvic or hip bone on that side in such a way that it can be moved in all directions, in, out, forward, and back.

In front of the knee is the knee cap or *patella*. It is a flat bone and can be moved with the fingers. It protects the knee in front. We rest upon it when we get on our knees.

Between the knee and the ankle are two bones, the *tibia* and *fibula*. The tibia is sometimes called the shin bone. Next to the femur it is the longest and largest bone in the body. At the upper end it is joined to the femur, and at the lower end to the bones of the foot. The fibula is a slender bone. It is located on the outer side of the tibia and like it extends from the knee to the ankle.

The Foot. — The heel and back part of the foot are made up of seven small bones called the *tarsal* bones. Of these the heel bone, which is called the *os calcis*, is the largest and strongest. The tarsal bones correspond to the carpal bones of the wrist. In front of the tarsal bones are five slender bones called the *metatarsal* bones. These correspond to the metacarpal bones of the hand. There is one metatarsal bone for each toe. They can be felt through the top of the foot. Joined to each metatarsal bone are the bones of the corresponding toe. The bones of the toes are called the phalanges of the foot. There are two bones in the great toe, as there are in the thumb, and three in each of the other toes, as there are in the fingers.

The purpose of the legs is to support the body when we stand and to enable us to move about, to walk, and to

run. While the bones of the hand and foot resemble each other in their number and arrangement, the hand is constructed for grasping things and the foot to support the weight of the body. For this reason the foot is shaped in the form of an arch. This arch sometimes gives way and becomes flattened. The condition is known as flat foot. When one has flat foot it is difficult to do much standing or walking. It is important that we take care of our feet and wear shoes that are properly shaped and which while supporting the arch do not cramp and distort the toes.

Questions

1. How many bones are there in the body?
2. What do the bones do for the body?
3. To what are the soft parts of the body attached?
4. What would our bodies be like if we had no bones?
5. What can you say about the shapes of bones?
6. Where in the body are there long bones? Where are there round bones? Where flat bones?
7. What is the outside of bones like? What can you say of the inside of bones?
8. What is the inside of bones filled with? Have you ever seen the marrow of a bone in a beefsteak? Have you ever broken the leg bone of a chicken? What was the inside like?
9. What makes bones hard? Do you know some things lime is used for? Do you know where the lime used in making mortar comes from? Where do you think the lime in our bones comes from?
10. What is the skull?
11. How many bones are there in the skull?
12. What can you say about the shape of the skull?
13. What is inside of the skull?
14. What supports the skull?
15. What is the backbone or spinal column? How long is it? How many bones in it?
16. Does the spinal column bend? When do we bend our spinal

columns? What would happen if we could not bend our spinal columns?

17. What is the thorax or chest?

18. What bones form the thorax? To what are the ribs fastened at the back?

19. What happens to your ribs when you take a deep breath?

20. What organs are inside the thorax?

21. Can you feel your heart beat through your ribs?

22. What is the name of the long bone of the arm between the elbow and the shoulder?

23. What bones are there in the arm between the elbow and the wrist?

24. What can you say about the bones of the wrist? Can you tell why the wrist can be bent in so many directions?

25. How many bones are there in the palm of the hand? Can you feel them through the back of the hand? Count them.

26. How many bones are there in the thumb? How many in each of the fingers?

27. Show in how many ways you can move the fingers and thumb? Could you do this if there were no bones in them?

28. What can we do with our hands that few animals can do? What animal can grasp hold of things and hang on to them just as we do?

29. Do you know where your collar bone is? Do you know its other name?

30. Do you know where your shoulder blade is? What is its other name?

31. Can you feel your shoulder blade move when you move your shoulder backward and forward?

32. What are the hip bones? What other names have they? Can you feel your hip bones?

33. What part of the leg is called the thigh? What is the name of the bone in the thigh?

34. To what bone is the femur joined at its upper end? In how many directions can the femur be moved?

35. What is the knee cap? Can you feel it with your fingers? What is its other name? Of what use is it?

36. How many bones are there in the leg between the knee and

ankle? Do you know their names? What is the other name for the shin bone?

37. What is the heel bone called?

38. In what way do the bones of the foot resemble the bones of the wrist and hand?

39. In what way do the bones of the toes resemble the bones of the fingers?

40. Can you move the toes in as many directions as you can the fingers? Can you grasp things with your toes?

41. What do you use your hands for? What do you use your feet for? Can each do its own work best? What is flat foot?

42. Could you walk and run if there were no bones in your legs and feet? Why not?

43. Does one ever break the bones of one's leg? What happens when a bone is broken?

44. Do people ever lose their legs? How?

45. What happens when one has one of his legs cut off?

46. Would you want to lose one of your legs? Why not?

CHAPTER III

The Muscles and What They Do for Us

In the preceding chapter we talked about the bony framework of the body to which the softer parts are attached. Now more than half of the softer parts consists of what are called *muscles*. It is the muscles of our bodies that make it possible for us to walk, run, talk, and do many other things. It is the muscles that move the different parts of our bony skeletons. If we move our legs or our arms, it is the muscles that do it. If we talk, it is the muscles of the chest, throat, mouth, and lips that enable us to make the different sounds. It is its muscles that enable the bird to fly, the deer to run, and the snail to crawl.

The lean part of meat is muscle. All of a beef steak that is not bone or fat is muscle. When we eat meat it is usually the muscle that we eat. Of course there may be some fat with it which is not muscle. It has been explained that the soft parts of the body are usually attached to the bones. You have noticed how the lean meat in a steak or a chop is fastened to the bone.

Muscles are made up of many little fibers somewhat as a rope is made, except that the muscle fibers are shorter than those in a rope and are fastened together but not twisted. These muscle fibers have the power to contract, that is to make themselves shorter. When they make themselves shorter, they at the same time become thicker

MUSCLES OF THE BODY

As they would appear if they were not covered by the skin.

just as an angleworm does when it crawls. When the fibers in a muscle contract, the whole muscle becomes shorter, and if the muscle is attached to a bone, the bone moves. If the bone is a leg bone, the leg is moved.

Muscles differ in shape. Some are long and slender like those in the arms and legs. Some are broad and flat like those forming the front walls of the abdomen. There is a muscle around the mouth shaped like a ring. When this muscle is contracted, the mouth is puckered and made smaller. Pucker your mouth and you will see how it works.

One of the uses of muscles is to make it possible for us to move about. By contracting the various muscles of our legs, first one set of muscles and then another, we are able to lift our feet one at a time, and move the leg forward, first one leg and then the other. In this way we walk. If we want to raise our hand to our mouth we do it by contracting the muscles of the arm and forearm.

Put your left hand on the muscle of your right arm between the shoulder and elbow. Now move the right hand up and down and you will feel the muscle under the left hand contract and bulge as the hand is raised and lengthen and flatten out as the right hand goes down. When the muscle bulges it contracts and pulls up the forearm and the hand. Shut your right hand up hard in a fist. Notice how the muscles in the thick part of your forearm harden and bulge. These are the muscles which close your hand and hold it shut.

When we chew food, it is the muscles of our cheeks that work the lower jaw. Place your fingers over one side of your face a little in front of one ear and feel how the muscle hardens and bulges when you shut your mouth

tight. These are the muscles that work the jaw when you chew your food.

The ends of many muscles are made up of tough, fibrous tissue called *tendons*. In many instances the muscles or their tendons pass over the bone joints, and being fastened to the bone above and below the joint, help to hold the joint together and to protect it. Thus there are a number of muscles which are fastened to the bone of the thigh above the knee by their upper ends and to the bones of the leg below the knee by their lower ends. These muscles help to hold the knee joint together. There are also muscles which help hold the elbow joint together, being fastened at one end above the elbow and at the other end below the elbow.

The abdominal wall is composed mainly of broad flat muscles. These are arranged in layers. The fibers of some run up and down and of some crosswise. Still others have their fibers slanted diagonally. All together they form a wall which holds in and supports the important organs of the abdomen. When these muscles are in good condition and strong they hold the organs well in and the abdominal wall is flat or but slightly curved out. When the muscles get weak, the weight of the abdominal organs pushes the wall out and causes what is sometimes called a big stomach.

The shape of the body is what it is mainly because of the muscles. If it were not for the muscles, our legs and arms would consist of little more than bones and blood vessels. It is the muscles that make them the size they are. It is the muscles of the body that give it the shape and curves it has. The skin and the layer of fat just beneath the skin help too, but the muscles are the most important.

The heart, of which we shall tell more later, is made up almost entirely of muscle. It is hollow, and when it contracts it pumps the blood through our bodies. Every time it beats, the muscle in its wall contracts, making the heart smaller, and forcing the blood out into the arteries.

We can contract some of our muscles whenever we want to, as we do the muscles of our arms, legs, and face. These are called the *voluntary* muscles because we use them voluntarily. There are other muscles in the walls of the stomach and of the intestines, which contract and work whenever there is food in the stomach or intestine. Over these muscles we have no control. We cannot make them contract or stop their working. Because we have no control over them they are called the *involuntary* muscles.

VOLUNTARY OR STRIPED MUSCLE

As it looks when seen through a microscope. Notice cross markings of the muscle cells. These are the kind of muscle cells found in the muscles of the arms and legs.

While all muscles look much alike, yet under the microscope we find that there is a difference. The fibers of the voluntary muscles have cross markings, and because of this are spoken of as *striped* muscle. The involuntary muscle fibers have no cross markings and are called *unstriped* muscle.

When a muscle contracts it produces heat. Much of the heat of our bodies is produced in this way, for some of our muscles are at work all the time. You all know that if you are cold, walking fast or running will warm you up. The body is made warm because of the heat produced by the muscles used in walking or running. This explains why when a person

is cold and in danger of freezing he should keep walking to keep the body warm, and why he should not lie down.

When a muscle is made to contract a great number of times, it gradually tires and does not contract so strongly as at first. In time it will stop contracting entirely. The muscle is then said to be fatigued. If it is allowed to rest for a time, the muscle will recover from its fatigue and will again work just as hard as it did at first.

MUSCLE CELLS FROM THE HEART

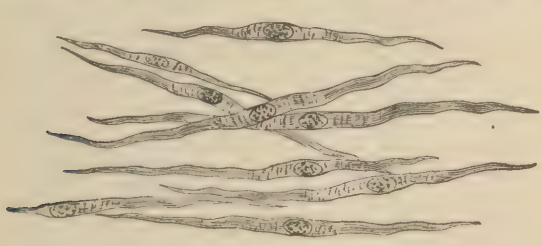
As they appear when seen through a microscope.

If we use our muscles properly they grow larger and stronger and tire less and less easily. If we do not use them, they get small and weak and tire quickly. If you ever had your arm or leg in a splint for two or three weeks, you know how small and weak the muscles became. If we use one set of muscles a great deal, they become large and hard. In men who are shoveling dirt and coal all day long, the muscles of the arms, shoulders, and back become large and hard. It is much better for most of us to exercise all our muscles some so that no muscle will be weak. All the muscles of our arms and legs and bodies should be exercised enough by play and work to keep them fit. We do not want to have big bulging muscles unless we are going to have daily use for them, as in lifting heavy loads or in swinging a sledge. Muscles will not stay big unless they are used. And big muscles are of no advantage

unless they are needed for heavy work. For most of us it is better to be agile and skillful in doing things than to be able to lift heavy weights. It is better to be able to play baseball or tennis than to be able to run a long distance.

Moderately developed muscles are more useful for most of us, and they also give the body a better and more pleasing shape.

Remember that our muscles make up a large part of our



INVOLUNTARY OR UNSTRIPED MUSCLE CELLS

As they appear when seen through a microscope. These are the kind of muscle cells found in the walls of the stomach and intestines.

body weight, and besides making it possible for us to perform many useful acts they have much to do with maintaining the symmetry and gracefulness of our bodies.

Questions

1. What are the muscles?
2. Does much of one's body consist of muscles?
3. What do our muscles do for us? What things do your muscles make it possible for you to do?
4. What part of beef steak is muscle?
5. What can you say about what muscles are made of?
6. What do we mean when we say that a muscle can contract?
7. What happens when we contract one of the muscles fastened to a bone? What do you do when you feel the muscle of your arm

as boys often do? Can you feel it contract and bulge, that is get shorter and thicker? Grasp the right forearm with the fingers of your left hand. Now open and clench your right fist. Can you feel the muscles of the forearm harden and get thicker?

8. What can you say about the different shapes of muscles? Why do you think muscles have different shapes?

9. What is the shape of the muscle around the mouth? What happens when it contracts and becomes smaller?

10. To what are muscles usually fastened? What are tendons?

11. How do muscles help to strengthen joints?

12. What is the shape of the muscles in the abdominal wall? What do these muscles do for us? When the muscles get weak what happens?

13. In what way do the muscles give the body its shape? What would one's leg look like if it had no muscle?

14. What is the heart made of? Do you know what the heart does?

15. Are there muscles in the walls of the stomach? Can you make the muscles of the stomach contract whenever you want to as you can the muscles of the arm?

16. What are the muscles called which you can contract when you want to? What are the muscles called over which you have no control?

17. Why are voluntary muscles sometimes called striped muscles? Why are involuntary muscles called unstriped muscles?

18. How do muscles produce heat? Why does running make you warm?

19. What happens to a muscle when it is kept working a long time? Can you tell why you get tired when you run or play hard?

20. How can we make our muscles stronger and so they will not tire so easily?

21. What happens to a muscle that is not used much?

22. Does one want big bulging muscles? Why not?

23. What kinds of muscle are most useful?

24. What makes the deer graceful in its movements?

25. In what way do properly developed muscles make one's body look better and make one more graceful?

CHAPTER IV

The Brain and Nerves and How They Control the Body

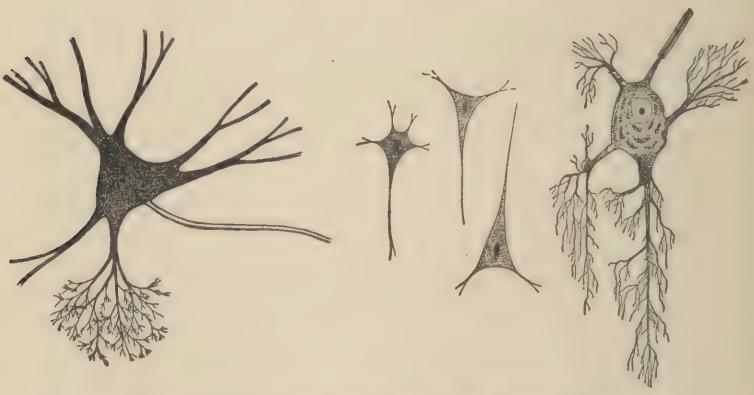
Inside the head is the brain. It is perhaps the most important organ of the body. It is protected from injury by the bony walls of the skull. Like all the other organs it is made up of cells, but the cells of the brain are different in shape from the cells which make up the other organs. These cells are all so small that we cannot see them unless we use a microscope. Some of the cells have many branches like a tree. All have at least one branch or projection. Some of the cells have one very long projection which under a microscope looks like a thread or a fine wire.

Connected with the brain is the spinal cord, which extends down in the center of the backbone or spinal column. The spinal cord is made up of cells resembling those in the brain. The brain and spinal cord taken together are called the central nervous system.

Extending out from the brain and spinal cord are what are called *nerves*. The nerves are made up of the long projections of the cells of the brain and spinal cord. These projections might be thought of as tails of the cells, but the cells are so small and these projections are so long that one would think of them more as being like fibers or wires. We will call them *nerve fibers*. Some of them are two or three feet long or even longer. They are as long as the nerves which they make up. There is one nerve which extends from the lower part of the spinal column

down the leg to the toes. The nerve fibers in this nerve are as long as the nerve itself, for the cells to which these fibers are attached are in the spinal cord.

The brain and spinal cord send out their nerve fibers in bundles called nerves to all parts of the body. It is through these nerves that we control the movements of the body. When you pick up a pencil from your desk,



NERVE CELLS FROM THE BRAIN AND SPINAL CORD

As they appear when seen through a microscope. Notice how they all have branches.

you do it because the brain sends a message down through the nerve fibers which extend down the arm and to the hand. These nerve fibers end in the muscles — some in the muscles of the shoulder, some in the muscles of the arm and hand. When the message comes from the brain, it runs down certain of the nerve fibers, and when it reaches the muscles at the end of the fibers, it causes the muscles to contract. In this way you move your hand forward to where the pencil is, place your fingers on the pencil, and pick it up.

The way the brain sends messages through the nerve fibers to the muscles is much like sending a telegram over a telegraph wire. The wonderful part of it is that the brain can tell just which muscles to contract when you want to do a certain thing. When you play ball, the brain has to tell the right muscles just when to act. The brain has to cause the muscles to act differently when you throw a ball, or catch it, or bat, or run bases. Whatever you do, the brain has to tell just the right muscles. Learning to do a thing is really teaching the brain how to control the muscles and make the right ones act at the right time. When you learn to swim or skate, it is the brain and spinal cord that you are teaching. They are the ones that must learn how to do it.

Showing How the Nerves Extend to All Parts of the Head and Face

We have learned how the brain is connected with the muscles of the body by the nerve fibers and why we can move our arms and legs when we want to, but there are also other nerve fibers that run to many parts of the body, especially to the skin. These fibers carry messages to the brain. The others you remember carried messages from the brain to the muscles. These fibers carry messages from the skin to the brain.

When you burn yourself, it hurts, and you feel pain. This is because the heat injured the little nerve endings in the skin, and immediately the nerves carried the message to the brain, and you felt the pain. If you touch a

hot object with your finger, as soon as the brain feels the pain it sends a message to the muscles of your arm and causes them to pull your hand away so it will not keep on getting burned and possibly badly injured. So you see the pain really serves a useful purpose and protects us from serious injury.

Showing How the Nerves Extend to All Parts of the Arm and Leg

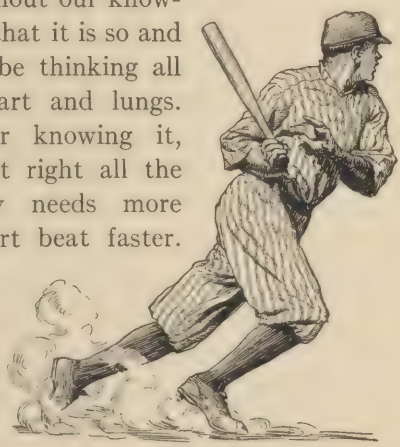
It is much the same if you run a pin into your hand or a nail into your foot. The little nerves that are injured carry the message to the brain and you feel the hurt. You then remove the pin or the nail. If it were not for these nerves, you would not know the pin or nail was there, and it would probably do you much more injury.

If a thing that is hot touches your skin, you know it is hot. If the thing is cold, you know it is cold. If a heavy object is resting on your foot, you know it is heavy. Different nerve fibers tell your brain these things so that it will know just what to do. The nerve fibers that can tell when a thing is hot are different ones from those that tell when it is cold. And still other fibers tell when an object is neither hot nor cold but just heavy.

So you see the skin is filled with the ends of these little nerve fibers, and they are all there to tell the brain when

we are being injured and in this way keep us from getting badly hurt.

There are other nerve fibers which connect the brain with the heart, lungs, and stomach. The brain controls these organs by the messages it sends through the nerve fibers, but it does it without our knowing it. It is fortunate that it is so and that we do not have to be thinking all the time about our heart and lungs. The brain, without our knowing it, keeps them working just right all the time. When the body needs more blood it makes the heart beat faster. When it needs more air, it makes the lungs take deeper breaths and work harder.



This Man by Practice has Taught his Brain, Nerves, and Muscles to Play Base Ball Well

But most wonderful of all, it is with our brains we do our thinking. It is through the working of little cells in the brain, that you learn your lessons. It is by the working of the brain cells that you do your problems in arithmetic. It is by the working of these cells that we remember to-day what we learned yesterday. It is the brain cells that tell us when we are happy and when we are sad.

When we sleep, it is really our brain that sleeps. When we sleep we neither see nor hear, and the brain does not keep telling us about the things around us. However, the brain does not stop working entirely. It keeps the heart beating and the lungs breathing. But they do not need

to work so hard as when we are awake, because when we sleep the body is quiet and does not need so much blood and air. So when we sleep our body rests, and although the brain keeps the heart and lungs working a little, they all rest.

When we feel tired, it means we need rest. When we feel sleepy, it means we need sleep. It means the brain and body have been working hard and want to rest. Our brains and bodies must have enough rest and sleep or they will not work well. You cannot play ball or skate or swim well when the body is tired, and you cannot study well when the brain is tired and has not had enough sleep. You learn your lessons much better when the brain is rested and has had all the sleep it needs.

If we want to do good work at school, we must have plenty of sleep, for a brain that is not rested will not work as well as it should.

Questions

1. Where is the brain?
2. Of what is the brain made?
3. What can you say about the shape of the brain cells?
4. Where is the spinal cord? In what way does it resemble the brain?
5. What are the brain and spinal cord together called?
6. What are the nerves?
7. What are the nerves composed of?
8. What are nerve fibers? How long are some of them?
9. Of what use are the nerves? When you pick up a pencil, what has happened to the nerves going to the arm? What has the brain done?
10. When you learn to do a thing, what part of your body is it that has been taught just how to do it?
11. When you learn to swim, what part of you do you teach? Explain why.

12. Touch your nose with your finger. Pick up a pencil. Tell how the brain and nerves make it possible for you to do these things.

13. What happens when you touch something which is hot? How do you know it is hot?

14. If you were to put your hand against a hot stove, and could not feel that it was hot, what would happen? Why is it fortunate that we feel pain when we touch hot things?

15. If you run a pin into your finger how do you know what has happened? What do you do?

16. How can you tell when a thing is cold?

17. How do you know when something heavy is resting on your foot?

18. Tell how your nerves protect you from injury.

19. Tell how the brain and nerves keep the heart and lungs working.

20. What part of your body do you use when you think? When you learn your lessons? When you do an example in arithmetic?

21. What happens when we sleep? What does the body do when we sleep?

22. Can a tired brain do good work? Why not?

23. What does sleep do for our bodies?

CHAPTER V

The Heart, Arteries, and Veins

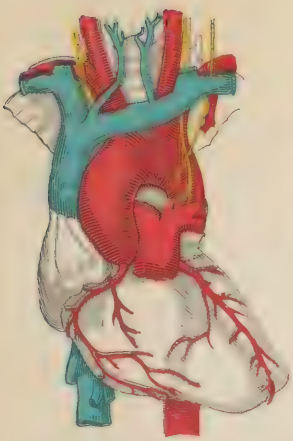
When you cut your finger or toe, it bleeds, and blood runs out of the cut. Wherever you cut your body, you will find there is blood.

THIS MAN IS JUST FINISHING A FIVE-MILE RACE

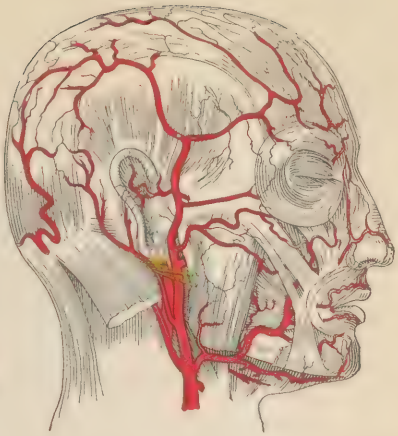
Notice the distress shown in his face. In running the race he has worked his heart very hard and may have done it some injury.

If you hold your hand over the left side of your chest in front, you will feel your heart beat. The heart is really a hollow pump made of muscle, and when it beats it is pumping blood to all parts of the body. It pumps the blood through pipes called *arteries*. Near the heart these pipes or arteries are large. Then they divide and become smaller like the branches of a tree. Finally they become very small. In the end of the finger they are so small you cannot see them. These very small arteries have thin walls, and some of the fluid of the blood passes through the walls to nourish the skin, muscle, and bone cells.

The rest of the blood then starts back to the heart through small vessels called *veins*. A lot of little veins join together and form a larger vein. These veins later



The Heart and the Large Arteries (red) into which it pumps the Blood, and the Large Vein (blue) which brings the Blood back to it.



Showing how the Arteries carry Blood to all parts of the Head and Face.

Showing how the Arteries carry Blood to all parts of the Leg and Foot.

Showing how the Arteries carry Blood to all parts of the Arm and Hand.

join and make still larger veins. Finally they all join one big vein and this carries the blood back to the heart.

The heart does not send this blood right back again to the muscles and bones and other tissues, but first sends it to the lungs to get some air. Then this blood returns to the heart, and freshened by the air it got in the lungs is again pumped to all parts of the body.

We spoke of the heart as a pump. It is really two pumps joined together. One of these pumps sends the blood to the lungs for air, and when the blood comes back to the heart the other pump sends it to all parts of the body to feed the body cells. All the organs and parts of the body are made up of little cells which have to be nourished, and it is the blood that carries to them the food and water they need.

Questions

1. What happens when you cut yourself?
2. What is the heart made of? What does it do?
3. What are arteries? What are they like?
4. Where are the arteries large? Where are they small?
5. What happens to the blood in the smallest arteries in the finger, in the skin and in the muscles?
6. What happens to the blood after it passes through the smallest arteries in the finger?
7. What are veins?
8. How does blood find its way back to the heart?
9. When the blood flows back to the heart through the veins, where does the heart send it next? Why?
10. What happens to the blood when it is sent to the lungs?
11. After the blood has passed through the lungs, where does it go? What does the heart then do with it?
12. What does the blood carry to the muscles, skin and bones?
13. How do all the body cells get water and food?

CHAPTER VI

The Alimentary Tract and What Becomes of the Food We Eat

The alimentary tract is that part of the body through which the food passes. It begins at the mouth, then comes the throat, then the esophagus, the stomach, and the intestine. It is like a long tube, bigger in some parts than others. The stomach is the biggest part of the tube. It is where the food first stops when we swallow it.

The food we eat is what nourishes all the cells of the body. The body must have food or it will die. An automobile gets its power by burning up gasoline. A locomotive gets its power by burning up coal. Gasoline is the food of the automobile and coal is the food of the locomotive. Our bodies get their power to do things by burning up the food we eat. The heart has to have food or it will stop beating. The lungs have to have food or they will stop breathing. Our muscles use up food whenever they work.

Food is not only burned up to give the body power and strength to do things, but some of the food is used to build up the body. Some of it is actually changed into muscle and bone and skin. Our bodies grow because the food we eat is changed into our flesh and blood.

Before food can be used by the body, it has to be ground up and changed into a liquid form. That is why the first thing we do when we eat is to chew our food up fine.

The finer we chew it, the better. Our teeth are given us for this purpose. When we chew our food, we not only grind it up, but we also mix with it the saliva of the mouth.

The saliva makes the food moist and slippery, so that it can be easily swallowed. It also starts the process of making the food into a liquid form. Making the food into

THE STOMACH

This is where the food goes when it is swallowed. It is partly digested here and then passes on into the intestine.

a liquid form in which it can be used by the body as fuel and for building muscle and bone is called *digestion*.

After the food is well chewed and moistened thoroughly with saliva, it is swallowed. It passes into the throat and from there into the esophagus. It passes down the esophagus and into the stomach, where it undergoes further digestion. The esophagus is a tube about nine or ten

inches long and has walls made up mostly of muscles. These muscles force the food along the esophagus and into the stomach.

The food remains for some time in the stomach, where it is mixed with a liquid called *gastric juice*. This gastric juice comes from little glands in the walls of the stomach. It is sour and contains acid. It helps dissolve and digest certain parts of the food, especially lean meat.

The stomach walls contain many flat muscles which keep contracting whenever there is food in the stomach. In this way the food is churned and well mixed with the gastric juice. The food stays in the stomach until it becomes a thick, soupy liquid. Then it passes out of the stomach into the intestine.

In the intestine other digestive liquids are mixed with the food, and here digestion is completed and the food passes through the wall of the intestine and into the blood. The food is then carried by the blood to all parts of the body, where it is used to do work and to build up the muscles, bones, and other tissues. It takes several hours for a meal to become digested in this way.

Some of the meat we eat contains tough gristle and sinew. This is what sometimes gets stuck between our teeth. Some of the vegetables we eat have tough, woody fibers in them. Parts of celery and asparagus have these tough fibers. The gristle of meat, the tough fibers of vegetables, and such things as the skins and seeds of apples, do not digest. They pass along with the food unchanged, and finally pass out of the alimentary tract.

To repair and build up the tissues and organs, the body has to have many kinds of food. We cannot be strong and healthy if we eat only meat, or only rice, or only bread.

Our bodies need a little meat or eggs, some milk, some vegetables, some fruits, some bread, and much water. Water is as necessary as any food. Milk is a good food, especially for growing children, as it contains lime and other things the body needs. Fruits and such vegetables as lettuce and spinach are also very good foods, for they contain some of the things the body must have to build up the tissues.

Some of our food we eat raw, some of it we cook. We cook some food to make it taste better. Some we cook to make it more easily digested. Some food we cook to make it soft and more easily chewed. However, we should not eat all soft food. We should have some food that is hard to chew, because the teeth need exercise. If we give the teeth plenty of work to do chewing the harder kinds of food, it will help keep them strong and in good condition. The teeth need work to keep them healthy just as the muscles do.

Questions

1. What is the alimentary tract? What is it like? Name some parts of it?
2. What is the stomach?
3. What does the food we eat do for our bodies?
4. In what way is our food like the coal burned in a locomotive? How is it like the gasoline in an automobile?
5. What does our food do for us besides give us strength to do things?
6. How does food make us grow?
7. What has to be done to food before it can be used by the body?
8. What are our teeth for?
9. Why do we chew our food up fine?
10. What do we mean by digestion of food?

11. When we take food into our mouths what do we do?

12. When we have chewed our food up fine and swallowed it where does it go?

13. How long is the esophagus?

14. What happens to the food when it reaches the stomach?

15. What is the gastric juice? Where does it come from?

16. How long does the food stay in the stomach?

17. Where does the food go when it leaves the stomach? What is the food like when it leaves the stomach?

18. What happens to the food when it reaches the intestine?

19. When food is completely digested, where does it go? How does it get into the blood? What does the blood then do with it?

20. How long does it take food to become digested and ready to be taken up by the blood?

21. Do we digest all the food we eat? Why not?

22. What becomes of the parts of food we can not digest?

23. Can you tell why we drink water?

24. What different kinds of food do our bodies need?

25. Why is milk an important food? Why are fruits and vegetables important?

26. What foods do we eat raw?

27. What foods are cooked before being eaten?

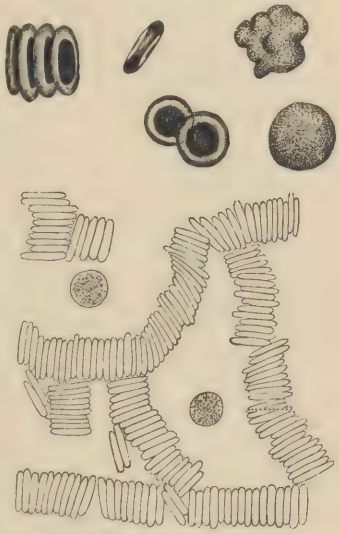
28. Why do we cook some foods?

29. Why should we eat some hard foods?

CHAPTER VII

The Blood and How it Carries Food to our Muscles, Bones, and Other Tissues

The blood as we see it when we cut ourselves, is a red fluid. But if we look at it through a microscope, we find that the blood looks yellow and consists of a straw-colored fluid with many round, yellowish bodies and a few larger colorless bodies. The round, yellowish bodies are called the *red corpuscles* of the blood. The others are called the *white corpuscles*. The red corpuscles give the blood its color.



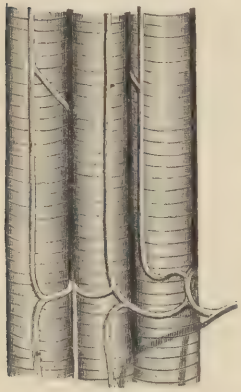
RED AND WHITE CORPUSCLES OF THE BLOOD

As seen through a microscope. The red corpuscles carry oxygen from the lungs to all parts of the body. The white corpuscles destroy microbes.

When digested food passes through the walls of the intestine and enters the blood, it becomes part of the fluid of the blood. When the blood passes through the lungs, oxygen is taken up by the red corpuscles from the air in the lungs. The blood then carries the food and the oxygen to all parts of the

body, where they are used either to do work or to build up tissues.

The food and the oxygen are used by the muscles when we walk and run. They are used by the stomach when it works and churns the food. The glands of the stomach make the gastric juice out of them. The saliva with which we moisten our food when we chew it, is made out of the food and the oxygen carried by the blood. When we think and when we work examples in arithmetic, our brains use up some of the food and oxygen. The heart itself as it pumps the blood gets the power to do it by using some of the food and oxygen in the blood.



VOLUNTARY OR STRIPED MUSCLES

Showing how the blood vessels extend to the muscle cells and carry blood to them to feed them when they work.

Some of the food in the blood goes to make muscle and bone. In this way our bones and muscles get larger and we grow. It is by changing the food in the blood to muscle, bone, and other tissue that the boy can grow to be a man and the girl to be a woman.

Of course all the tissues, even the bones, have to have water or they would become dry like paper. In fact we can get along without food longer than we can without water. We get the water we need just as we do our food. Most food contains some water. Then we drink some. We really should drink a great deal.

When we drink water it passes into the stomach just as food does. Then it goes from the stomach into the

intestine. The water passes through the walls of the intestine with the digested food and enters the blood. Then the blood carries it to all parts of the body.

Some of the water in the blood is given off in the lungs to the air we breathe. If you blow your breath against a cool looking-glass you can see the moisture collect on it. This is water which the blood gave off to the air in the lungs. In winter when it is cold you say you can see your breath. This is the moisture you see in the air breathed out from the lungs.

In warm weather the blood gives off some of its water through the skin. That is what is happening when you perspire. If you perspire a great deal the blood may lose a lot of water, then you get thirsty and go and take a drink. When you get thirsty it is the blood saying it wants more water.

Questions

1. What does blood look like when you cut your finger?
2. What does blood look like when seen through a microscope?
3. What does the blood carry to all the tissues and organs of the body? Where does it get the food it carries? Where does it get the oxygen?
4. What part of the blood gathers oxygen from the lungs?
5. What do the tissues and organs of the body do with the food and oxygen carried to them by the blood?
6. What would happen to the tissues and organs if the blood did not carry water to them?
7. How does the water we drink get to the blood?
8. When on a cold day you can see your breath, what is it you see?
9. Where does the water come from when you perspire?
10. What does it mean when you are thirsty?

CHAPTER VIII

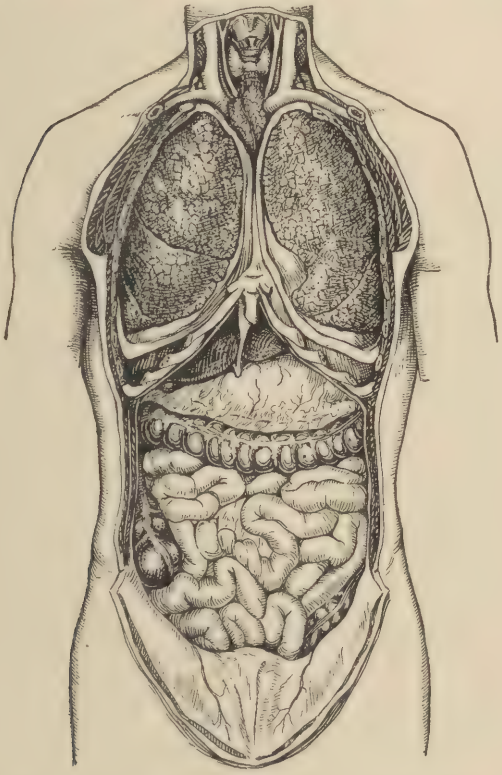
The Lungs and Why We Breathe

You have learned that the organs and tissues of the body have to have food so they can do the things each has to do. The muscles need food so they can contract; the heart needs food so it can pump the blood. The organs and tissues also need what is called oxygen. They can use the food only if they have oxygen to combine with it.

We get oxygen from the air when we breathe. The air is made up of oxygen and nitrogen and small amounts of other substances, all in the form of what we call gases. Usually we cannot feel the air. However, when the air moves rapidly, as when the wind blows, we do feel it. A wind is simply air moving rapidly. There are other kinds of gases of which you know something. There is the gas which is used in gas stoves for cooking. This same gas is sometimes used for heating and lighting houses. It is usually made from coal and is not good to breathe. In fact it makes us sick if we breathe much of it, and it may even kill us. It is very poisonous. Then there are the gases with which balloons are filled. These are all different from the air.

One fifth of the air is oxygen gas, and about four fifths are nitrogen gas. The body does not use the nitrogen in the air, but it is not poisonous and it does no harm to breathe it. The air surrounds the earth. It extends up

from the earth for many miles. So we really live at the bottom of an ocean of air. Although the air extends up from the earth many miles it becomes thinner and



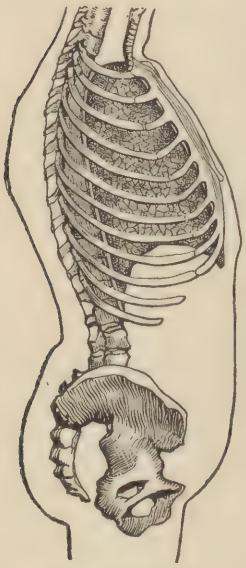
THE LUNGS IN THE UPPER PART OF THE BODY

This is where the air goes when we breathe it in. It is here the blood gets the oxygen which it carries to all parts of the body. The lower part of the body shows the intestines.

thinner as one leaves the earth. If one goes up in a balloon, when he gets up about two miles the air is enough

thinner so that he notices it, and five miles up it is so thin that there is hardly enough to breathe. But down on the earth there is plenty of air, and we breathe it all the time and seldom think about it.

The organ with which we breathe is called our *lungs*. Our lungs fill up most of our chests. When you take a deep breath the chest moves out and gets larger. The lungs contain many little spaces which fill with air when we breathe. The air goes in through the nose, then down past the throat and through the windpipe. The windpipe is called the *trachea*. It branches in the lungs like the branches of a tree. At the ends of the smallest branches are the air spaces or cells, just as the leaves of a tree are at the ends of the smallest branches.



THE BACK BONE OR SPINAL COLUMN, THE RIBS, AND THE HIP BONES

The lungs are shown in the chest protected by the ribs.

We breathe by making our chests large, then small. When we make our chests large, the air flows in through the nose and windpipe and fills the air spaces of the lungs. When we make our chests small, the air is forced out of the lungs through the windpipe and nose. As we breathe, the air flows into and out of the lungs.

Now all through the lungs in between the air spaces are blood vessels filled with blood pumped there by the heart. The walls between these blood vessels and the air spaces

are very thin, and the little red blood corpuscles take up from the air in the lungs some of its oxygen. The corpuscles take up very little of the nitrogen in the air, but much of the oxygen. While the corpuscles are taking up the oxygen, the blood gives off certain waste products which it needs to get rid of. So the air that we breathe out of our lungs has less oxygen than when we breathed it in, and it also carries off waste products from the blood. The air gives oxygen to the blood and takes away waste products.

When the blood goes to the lungs it is dark and has very little oxygen, but when it leaves the lungs and goes back to the heart it is bright red and carries much oxygen. The heart then pumps this bright red blood with its oxygen to all parts of the body, where the oxygen is used by the organs and tissues just as food is. When the oxygen in the blood is used up, the blood again becomes darker in color and returns to the lungs for more oxygen.

We can live for many days without food, and we can live for several days without water, but we can live only a few minutes without air. The oxygen of the air is more important to us than either water or food.

Questions

1. What do the organs and tissues have to have besides food and water?
2. What does the air consist of?
3. What is oxygen? How much oxygen is there in air? What other gas does air contain?
4. How deep is the ocean of air which surrounds the earth?
5. Can you see the air? Can you feel it? What is a wind?
6. If you were to go up in a balloon, what would happen when you got up five miles in the air?

7. In what way do the body tissues and organs use oxygen?

8. How does the body get the oxygen it needs?

9. What can you tell about how we breathe? How are the lungs made to fill with air? How is the air forced out of the lungs?

10. How does the blood take up oxygen from the air in the lungs? What do the red blood corpuscles do?

11. What does the blood give off in the lungs?

12. In what way is the air we breathe out of our lungs different from the air breathed in?

13. What change takes place in the blood as it passes through the lungs? What is the change in color? What does the blood carry away from the lungs?

14. How long could we live without food? How long without water? How long without air?

PART II

Personal Hygiene, or How to Keep Well and Live Long

CHAPTER IX

Food — Why We Eat and What to Eat

When boys and girls grow, their bodies increase in size. A young baby weighs eight or ten pounds, while a boy in high school may weigh 150 pounds, and a girl 130 pounds. This increase in weight of more than one hundred pounds is possible because our bodies have the power of changing food into bone, muscle, and blood; yes, and into brain and heart too.

As long as we live the organs and tissues of our bodies are working. The heart continues to beat all the time, the lungs never stop breathing, the liver is always at work, and so it is with all the tissues and organs. When they stop working, our bodies die. But to do work requires energy. The body gets its energy from the food we eat. Some of our food is consumed in the body, really burned up much as coal or wood is burned in a stove, and in being burned it gives off energy and heat. The energy gives us the power which makes it possible for our hearts to beat and our lungs to breathe and our legs to walk, just as the coal burned under the boiler of a locomotive gives off the energy which pulls the train. The heat given off as our food is burned up keeps the body warm.

So you see the reasons we eat are:

First — To give us food which the body can make into bone, muscle, and blood so we can grow to full size.

Second — To give us food which can be burned up in

the body and furnish energy to the heart, lungs, and muscles, and in fact to all the tissues and organs; and

Third — To give us food which can be burned up in the body, and in being burned will give off heat to keep the body warm.

The food of children should consist of the kinds that will make their bodies grow, so that they will become strong, healthy men and women. The food of grown men and women should consist of the kinds that will furnish their bodies enough energy and heat and keep them strong and healthy. Children who have eaten the kinds of food that properly nourish the body while they are growing will become stronger men and women and will live longer than children who do not.

What foods contain. — Most foods contain much water. Vegetables and fruits contain a great deal of water. Even meat and eggs have considerable water in them. Milk is about seven eighths water. However, it contains less water than many of the vegetables and is an excellent and important food for both growing children and adults as we shall see later.

The parts of food not water consist mainly of substances called *proteids*, *carbohydrates*, and *fats*. They also contain substances called inorganic *salts* and *vitamins*.

Proteids. — Proteids are substances which are used chiefly to build up the body and make tissue. They build up the body when it is growing and also renew the tissues that are used up in work and play. Milk, eggs, and meats contain more proteids than other foods. Peas and beans contain considerable proteid. Cereals such as wheat and corn have some. Many other foods contain small amounts. There are many different kinds of pro-

teids. Those in meat are not the same as those in milk. Those in cereals are still different. Some are much better than others for building up the body and making it grow. Some of all of them are useful and give to the body something it needs. For supplying to the body the proteids it needs, liver and sweetbreads are better than beefsteak and roasts. But the proteids of milk and eggs are the most useful of them all and the most necessary. The food of growing boys and girls should consist in part of milk and eggs — a quart of milk and at least one egg a day.

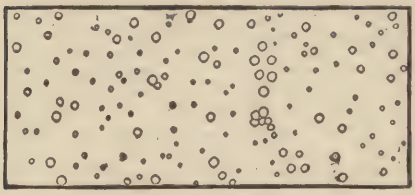
Carbohydrates. — Carbohydrates are such substances as sugar and starches. They are used by the body mainly to burn up and produce heat and energy. They are used by the body but little to build up tissue or to make it grow. Their chief purpose is to supply the fuel needed to keep the body warm and to supply the energy needed by the organs in doing their work, by the heart in its continuous beating, and by the muscles we use in work and play.

Much of the solid part of vegetables, fruits, and cereals consists of carbohydrates. Wheat, corn, rice, beets, and potatoes contain large amounts. A considerable part of the solids of milk is carbohydrates in a very useful form.

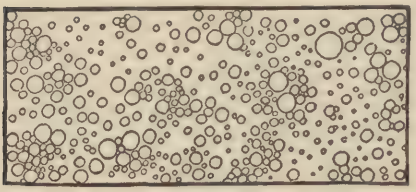
Fats. — The fats contained in food are butter, olive oil, cottonseed oil, lard, the fats on meat, and the oils in nuts and seeds. The fats serve the same purpose in food as do the carbohydrates, that is, they are burned up to yield heat and energy. Some fats are useful in the food. Butter, which is the fat from milk, is especially suitable for use by the body and may either be eaten as butter on bread and on vegetables or taken as a natural part of milk.

Inorganic salts. — To allow it to grow, and to build up

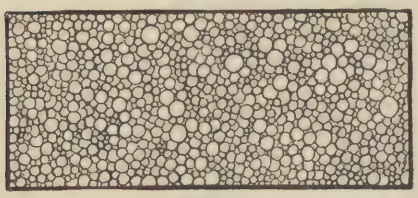
the tissues, and to enable the various organs to work properly, the body needs a constant supply of such substances as iron, calcium (lime), iodin, potassium, sodium, magnesium, phosphorus, and sulphur. These are called inorganic salts. It needs only small amounts of these, but it must have them or the body will not grow properly. If we do not get enough of these substances in our food, we shall not be healthy and strong. Some of these substances are necessary to build up the bones of the growing boy and girl. All are necessary to maintain health.



Skimmed Milk



Milk



Cream

FAT GLOBULES IN MILK AND CREAM

These fat globules are really little masses of butter.

Most foods contain small amounts of some of these substances. Milk contains most of them and has particularly large amounts of calcium (lime). If we do not drink milk, we are very likely not to get enough calcium to keep our bodies in the best condition. Some of these substances not contained in sufficient amount in milk, meat, and bread, are contained in vegetables, particularly the leafy vegetables such as lettuce, spinach, cabbage, and cauli-

flower. The best way to get all the inorganic salts we need is to drink plenty of milk and eat lettuce, spinach, and other vegetables.

Vitamins. — Vitamins are substances necessary to the body. Without them the body cannot use properly the other foods, nor can it grow. Without them we cannot be well or strong no matter how much other food we eat. We need them only in small amounts, but we need them very much.

As yet we do not know a great deal about vitamins except that they are contained in certain foods and not in others. The foods which contain the vitamins we need are milk, butter, eggs, lettuce, spinach, oranges, apples, cabbage, carrots, and onions. Many other foods contain vitamins in smaller amount. Many foods contain none.

The easiest and best way to get the vitamins we need to make our bodies grow and to keep us healthy and strong, is to drink plenty of milk and to eat vegetables such as lettuce, spinach, and cabbage, and some fruits, such as apples and oranges.

Questions

1. What happens to our bodies as we grow?
2. Out of what does the body make itself larger as it grows?
3. From what do the organs of the body get their energy to keep them working?
4. What does food furnish to the body besides energy?
5. What keeps the body warm? How?
6. What are the three reasons why we eat?
7. What kind of food do growing boys and girls need? Why?
8. What substances do foods contain?
9. What use does the body make of proteids?
10. What foods contain proteids?

11. Are there many different kinds of proteids? Which foods contain the most important proteids?

12. What are carbohydrates?

13. What use does the body make of carbohydrates?

14. What foods contain carbohydrates?

15. Name some of the fats used in foods?

16. What use does the body make of fats?

17. Name some of the inorganic salts the body must have. Where does the body get these substances?

18. Does milk contain many of the inorganic salts the body needs? Which one does it contain in largest amount?

19. Why should one's food consist in part of leafy vegetables?

20. How can we be sure to get all the inorganic salts our bodies need to keep them in good condition?

21. What do you know about vitamins?

22. What foods contain the vitamins the body needs?

CHAPTER X

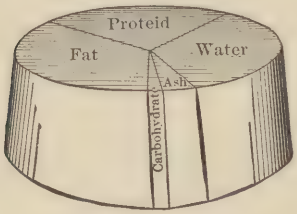
Food — Why We Eat and What to Eat (*Continued*)

Food for boys and girls. — From what we have learned we see that the purpose of food is to furnish the body the substances it needs to build it up and make it grow, the substances it needs to burn up and produce heat and energy, and certain substances which are necessary both to cause growth and to make all the organs and tissues work properly and keep us in health.

We need proteids, carbohydrates, fats, inorganic salts, and vitamins. In some ways the most important, and the ones we are most likely not to get enough of, are vitamins and inorganic salts. No one food contains all of these we need. Milk contains most of them and if we were to eat only one food, the one we would get along on best is milk. Milk contains proteids, carbohydrates, fats, many of the inorganic salts, and some of the most important vitamins.

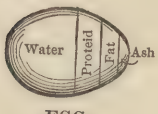
The foods which will furnish us with the necessary substances we are most likely not to get enough of are milk, eggs, vegetables such as lettuce, spinach, and cabbage, and fruits like oranges, grapefruit, and apples. But to give the body all the many foods it needs we should also eat other things as well. We should eat some of the grains or cereals such as wheat, corn, and rice. We get wheat in white bread and in some of the so-called breakfast foods. We get corn in corn bread and Johnny cake. Rice is usually eaten boiled or in pudding. We can get

many of the proteids we need in peas and beans and in eggs and meat. Eggs are better than meat. The fats we get in butter and in milk and some in meat and in other foods. The carbohydrates we get in milk, bread, and vegetables. Potatoes consist mostly of carbohydrates and water. The vitamins and inorganic salts will be got chiefly from milk, butter, the leafy vegetables, and fruits.

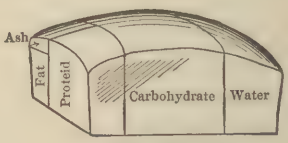


CHEESE (FULL CREAM)

POTATO



EGG



WHITE BREAD [a]

SHOWS THE RELATIVE PROPORTIONS OF PROTEID, CARBOHYDRATE AND FAT IN WELL-KNOWN FOODS

The important things for boys and girls to eat in addition to other food, if they wish to grow as they should and be healthy and strong, are milk, leafy vegetables such as lettuce, spinach, and cabbage, bread and cereals, and fruits. They may eat of the other foods, but they are of less importance.

Preparation of food. — We eat to feed our bodies. If our food tastes good and we enjoy eating it, so much the better. Our food should be made to taste as good as

possible, but nothing should be done to it which will make it harder to digest; that is, harder for the body to use it. The cooking and preparation of food should make it more easily used by the body or more pleasant to eat, but never harder to digest.

Boiling rice and potatoes and most other vegetables makes them taste better and at the same time more easily used by the body. The same is true of making flour into bread and cooking it. These foods all contain large amounts of starch, which is changed to a more easily digested form by the heat in cooking. All cereals and vegetables such as potatoes, beets, and turnips contain considerable starch and are usually cooked by boiling in water on top of a stove or by baking in an oven.

Sometimes people put foods in fats such as butter or lard or the fats from meat and cook them on top of the stove. This is called frying. When food is cooked in this way it is likely to become soaked in fat and greasy. While butter is a good food eaten in moderate amount, food that is soaked in fat and is greasy is usually not a good food. It is often very hard to digest. Food should not be soaked in grease when it is cooked.

Making bread is simply one way we have of preparing the cereals so they will be pleasanter to eat and at the same time easier to digest. Wheat grain would be hard to chew and not very pleasant to eat. But grind it up fine into flour and make it into bread and we have a food we all like and which the body can digest and use easily. You would not care to eat much whole corn. But grind it up into meal and make corn bread and we have a pleasing food.

The simplest way of preparing the grains or cereals for

food is to make porridge. Ground wheat, called cream of wheat, or ground corn, called corn meal, or crushed oats, called rolled oats, are boiled in water to make porridge. This eaten with milk or cream is a very good food.

Making cakes, cookies, pies, and tarts is also preparing food in a form pleasant to the taste. They all consist of wheat flour mixed with butter or some other fat, and sugar, and then cooked. Pies and tarts have fruit or jelly added. They are all made of foods we should eat, but usually have so much fat and sugar in them that we should not eat much of them. Pie crust usually has so much fat in it that it is like fried food and is hard to digest. Cakes are likely to have so much sugar in them that they are very sweet, and very sweet food is not good. It takes away our appetite and makes us not want to eat the food we really need and our bodies should have. We should eat only small amounts of cake or pie, because we need the other foods so much more.

Lettuce and celery and fruits are usually not cooked. They are better foods eaten raw. In fact, we get the most good from them only when we eat them uncooked. Milk also does not need cooking if it is known to be good milk. Milk is not only one of the best foods but requires less preparation than most.

The cooking of food is simply preparing cereals, vegetables, and meats in such a manner that they will be easy to digest and pleasant to eat.

Foods growing boys and girls should avoid. — In cooking and preparing food we should make it taste good and look attractive. In our efforts to do this, however, we should not forget that the purpose of food is to nourish the body. No matter how good a thing tastes or how at-

tractive it looks, if it has been so prepared that it is hard to digest it is not good, and its preparation and cooking have been a failure.

Pastries. — Pies and other pastries often have so much butter or lard in them that the crust is full of these fats and is hard to digest. Most pastries are hard to digest and should be eaten only in small amount.

Fried food. — Cooking food in hot fat is called frying it. Some food substances can be cooked in this way without becoming soaked in the grease, but usually fried foods are grease-soaked and are used by the body only with great difficulty. As a rule fried foods should be avoided as much as possible.

Pickles. — Pickles have little or no food value. They are eaten with other things because of their taste, that is, to make the food taste better. Things eaten in this way to flavor or give taste to food are called condiments. Eaten in small amount they are not harmful, but boys and girls should avoid eating much of them. Catsup and chili sauce are also condiments and should be eaten sparingly.

Tea and coffee. — Tea is made by pouring boiling water over tea leaves, and coffee is made by pouring hot water over ground coffee beans. Both tea leaves and coffee beans have in them a drug called *caffein*, which is dissolved out by the hot water and is contained in tea and coffee as prepared for drinking. Caffein even in small amounts makes the heart beat faster, keeps one from sleeping, and tends to make people restless and sometimes excitable. Tea and coffee have no food value. They do not nourish the body. They throw extra work on the heart, and keep people from getting as much rest as they

should. Boys and girls who wish to have good health and to have their bodies grow should not drink either tea or coffee.

Tobacco. — While we are talking about tea and coffee, we should perhaps speak also of tobacco. Tobacco is not a food, of course, and is not taken with food. However, some people chew it, and many persons smoke after eating. We said how in drinking tea and coffee people took into their bodies the drug caffein. In smoking people take into their bodies the powerful drug *nicotine* and certain gases from the burning tobacco. These are all especially harmful to growing boys and girls. Nicotine lessens the desire for food. It interferes with the proper action of many of the organs and tissues, and thus lessens growth. If a growing boy smokes he will not do as good work in school nor do as well at games as he would if he did not. A boy who wants to do well at school or to grow to be as big and strong as possible must not use tobacco.

Questions

1. What can you say of the kinds of food a growing boy or girl needs most?
2. What should be the purpose of cooking and preparing food?
3. Why are rice, potatoes and vegetables cooked before being eaten? What does the heat in cooking do to the starches in these foods?
4. What can you say about cooking food by frying it in grease?
5. Does bread taste better than wheat would? Why is wheat ground into flour and made into bread before it is eaten? What is done to corn to make it a more pleasant and more easily digested food?
6. What is the simplest way of preparing the cereals for food?
7. How do cakes and cookies differ from bread?

8. What foods are best eaten uncooked?
9. Why should one not eat much of cakes, cookies or pies?
10. Why are fried foods usually hard to digest?
11. What can you say about the eating of pickles and catsup?
12. How is tea made? How is coffee made?
13. What do both tea and coffee contain?
14. What effect on the body do tea and coffee have? Are they of any use as a food?
15. Why should growing boys and girls not drink coffee or tea?
16. What poison is contained in tobacco? How does this poison get into one's body?
17. What is the effect of nicotin when taken into the body?
18. Why should growing boys or girls not use tobacco?

CHAPTER XI

Why We Drink and What to Drink

Two thirds of the weight of the body is water. The blood contains water. All the organs and tissues, even the bones, contain water. The body cells, that is, the little cells which make up the organs and tissues, are themselves made up in large part of water, just as an orange or a lemon or a melon is. The saliva with which we moisten our food when we chew it is mostly water. So is the gastric juice which the stomach secretes to help digest our food.

The body is giving off some of its water all the time. The air which we breathe out of our lungs carries with it some water in the form of vapor. The body is losing water constantly through the skin in the form of perspiration. On a hot day we lose a great deal in this way and then we notice it as sweat. But usually the water given off by the skin evaporates as fast as it forms, and we do not notice it. The body also loses water in other ways.

In all, the body loses two or three quarts or even more water a day. We have to take into our bodies just as much water as we lose, for if we do not, the blood will become too thick and the body cells will not have all the water they need. The body gets water in two ways, from the food we eat and from the things we drink.

Practically all foods contain some water. Fruits and vegetables contain a great deal. Many of them are almost

all water. Even apparently dry foods such as bread and crackers contain a little. But we do not get all the water we need from foods. That is why we have to drink.

The purpose of drinking is to furnish the body with enough water. Usually we drink plain clean water. Sometimes we put lemon juice and sugar in it and then we call it lemonade. Sometimes ginger and sugar are put into it, and it is put up in bottles. Then we call it ginger ale. Sometimes other flavoring is put in, and we call it pop, or soda water. Some people drink tea and coffee. These are simply hot water into which tea and coffee have been put. They contain a drug called caffein which is to some extent a poison and is not needed by the body. Children especially should not drink tea or coffee, and most people would be better off without it.

The best way to give the body the water it needs is by drinking pure water. Pure water is clean and clear and has no taste or smell. If it has a taste or smell, it is because there is something in the water which should not be there.

When the body has lost some of its water and needs more we feel thirsty. The feeling of thirst is the body letting us know that it needs more water.

Questions

1. How much of the body's weight is water?
2. What can you say about the water lost by the body through the lungs and skin?
3. How much water does the body lose in a day?
4. What would happen if the body kept losing water and was not given more?
5. How does the body get the water it needs to make up for what it loses?

6. Why does one drink more water in warm weather than one does when it is cold?

7. What can you say about the water in foods?

8. What is the best way to give the body the water it needs?

9. What does it mean to be thirsty? What might happen if the body did not let one know when it needed more water?

CHAPTER XII

The Kind of Air We Should Breathe

You have learned how we breathe air into the lungs so that the blood can get oxygen to carry to all the organs and tissues of the body. You have also learned that the blood gives off in the lungs certain waste products which are carried off by the air we breathe out.

The best air is pure air. Like water, air should be clean and should have no odor. If it contains smoke or dust, these get into the lungs, and they are not good for them. A coal miner's lungs get dark and sometimes almost black from the constant breathing of the coal dust. A stone-cutter may get into his lungs fine stone-dust which will in time harden his lungs and do them damage. Even street dust in the air is bad for us, for although most of it is stopped in the nose as we breathe in the air, some of it may find its way down into the lungs.

Some people cannot breathe air containing the pollen of certain plants without getting a condition resembling a cold in the head called "hay fever." Some plants, such as rag weed and hay, give off to the air great quantities of pollen when their flowers are in bloom. This pollen is like a very fine dust and usually cannot be seen in the air, but if some people breathe it they quickly develop hay fever or asthma. However, it does little or no harm to most people.

You have probably heard that outdoor air is better for

us than air indoors. Let us see if from what we have learned we can tell why this is so. We know that the body is always warm and that it is constantly giving off heat and also water in the form of perspiration. We know also that while the air we breathe into our lungs may be cool and dry, the air we breathe out is warm and full of moisture. Because this is so, if we sit quietly in a room with the doors and windows closed, the air about us becomes warm and moist. If there are many people in the room, all the air becomes warm and moist. Then we feel less comfortable and may get drowsy, because when the air about us is warm and moist and quiet, the body cannot so well get rid of the heat that it is all the time making. The body is at all times making heat within itself as it uses up, or really burns up, the food we have eaten. The heart, as we learned, makes heat as it beats. The lungs make heat as we breathe. The stomach and liver and muscles all make heat, and the body has to get rid of all this heat or we become too warm.

You have noticed that as long as the room is cool, the air does not seem close and you do not get drowsy. Or if in a room in which the air has become what we call close, — that is, warm and moist, — an electric fan is started, you feel better at once. This is because the fan keeps the air moving so that the warm moist air about our bodies is constantly blown away and the body can better get rid of its heat. If the windows and doors are opened so that the outside air blows in, we also feel better, and the air seems fresh, as we call it. All the moist warm air is blown away so that our bodies are constantly bathed in cooler, drier air, and we get rid of the heat of the body so much the better.

The outdoors is so much bigger than a room, and the outdoor air is usually being moved about by at least some breeze, even if it is so gentle we cannot feel it, so that outdoors warm moist air does not collect about us but is constantly carried away. As a result, the body can get rid of its heat much better when we are outdoors.

You have noticed at times in summer when it is hot and even the air outdoors seems perfectly still, how hot and uncomfortable you feel. Then if a breeze comes up how much more comfortable you become!

The outdoor air is better for us, because the breezes and constant movement of the air carry away from us the heat and moisture we give off and keep our bodies bathed in cooler and drier air. This makes it easier for the body to give off the heat it is constantly making and must get rid of.

The air we breathe should be clean. Outdoor air is best.

Questions

1. Why do we breathe air?
2. What kind of air is best? Why should the air we breathe be clean?
3. Why should the air we breathe not contain smoke or dust?
4. What happens to the lungs of a coal miner?
5. What may happen to the lungs of a stone cutter?
6. What causes hay fever?
7. What happens to the air of a room in which there are many people? How does it make one feel?
8. Why does the breeze from an electric fan make one feel more comfortable in hot weather?
9. Why is outdoor air better for us than indoor air?
10. Can you tell why people who live outdoors most of the time usually have better, stronger bodies than do people who spend most of their time indoors?

CHAPTER XIII

How Work and Play Train the Body

You have learned about the body and how it can be trained to do many things. You have learned how the muscles and the brain can be taught to work together so that we can swim, skate, and play ball. We teach the body to do things by doing them. Some of the things we do we call play and some we call work. Usually the things we like to do we call play, and the things we do not like to do we call work. There is really very little difference between work and play except that we like to do some things better than others.

The carpenter makes boxes and builds houses to earn money and thinks of it as work. The school boy makes boxes and builds little houses and thinks of it as play. The professional baseball player plays ball every day to earn money, and to him it is work. The boy plays ball, and it is play — not work. A girl will be asked by her mother to take care of her baby sister, and she thinks of it as work, but she will play with her dolls and pretend they are babies she is taking care of, and to her it is play. So whether doing a thing is work or play depends on how we think of it. If we think of work as play, it becomes play. If we think of play as work, it becomes work.

Whether we work or play we are training the body to do things, provided we work and play properly. The body needs the training it gets by doing the things we call

work, just as much as it does the training it gets by doing the things we call play.

Boys and girls in school usually think of their studies as work, but in getting their lessons and doing their school work they are teaching their brains to know many things and especially how to think correctly. Geography teaches us about the earth and its land and seas and about the various countries and the people who live in them. History teaches us what people did in the past. Grammar teaches us how to speak and write correctly. Nature study and botany, geology and astronomy teach us about the world in which we live. We certainly all want to know just as much as we can about this world in which we must spend our lives. Arithmetic and algebra teach us how to work out certain kinds of problems which will be very useful to us, and especially do they train the brain to reason.

But to get the most good out of work and play, whatever we do, we should do just as well as we can. Each time we do a thing we should try to do it better than we ever did it before. In this way we train the body to do things better and better. If we do not do things well, we teach the body bad habits. Unless we train the body to do things constantly better, it is not getting the benefit it should from the work or the play. If we try each time to do our work, whatever it is, better than we did it the time before, it becomes a game, and then it is play.

There is another reason why we must all do work. There is much work to do if we live as we want to live. Somebody must prepare and cook our food. Somebody must make our clothes. Somebody must build our houses. Somebody must make our roads. If we are to have food,

clothes, houses, and roads, each one must help in some way. Tramps try to get along without doing work, and try to have others do all their work for them. But who wants to be a tramp?

For the boy and girl all work and play should be a game and the object of the game should be to train the body to do things well.

Questions

1. How do we train our bodies to do things?
2. How does one learn to skate or swim or do problems in arithmetic?
3. What is the difference between play and work? Is building a toy house play to a boy? Is building houses play to a carpenter? What is the difference?
4. What do work and play do for our bodies?
5. Do you study history at school? Do you think of it as work or as play?
6. Do you read story books? Do you think of reading them as play or work?
7. How can work be made play?

CHAPTER XIV

The Need for Sleep

When we work or play for a time we become tired. When we use actively the muscles of our legs or arms, the muscles in working use up the food which the blood carries to them, and in doing this there are left in the muscles waste products, just as when you burn coal in a furnace smoke is given off and ashes are left. Smoke and ashes are waste products. The muscles in working not only use up food carried to them by the blood, but the muscle cells use up also part of their own substance. For this reason after they have worked awhile they begin to refuse to work, because they have used up a large part of their material. The muscles are then tired.

But you know that muscles are controlled by nerve cells, and whenever a muscle contracts it is because certain nerve cells in the brain or spinal cord have sent messages to the muscle cells and caused them to contract. In doing this the nerve cells use up some of their substance, and after they have worked in this way for a time in keeping the muscles working, they too give off waste products and become partly worn out and tired.

Also when we study the brain cells use up part of themselves, and after a time become partly exhausted and tired. And as the heart keeps beating and the lungs breathing all day long, their cells use up food material, give off waste products, and become tired.

In this way there accumulate in the body waste products which in a sense are poisons, because the tissues and organs, the muscles, the brain, and the heart, cannot work well until the body gets rid of them. Then too as we work and play during the day the muscles and body organs become tired. Then we get weary and sleepy. When we get tired and sleepy, it is because the body cells are tired and have in them and around them the waste products they have formed in working.

We go to sleep tired and weary. In the morning we wake up refreshed. We are no longer tired. We are ready again to work and play. Something has happened while we were asleep to make this difference.

While we were asleep the body was perfectly quiet. The muscles and brain stopped working. Even the heart slowed down and beat more gently and the lungs worked less hard and breathed more slowly and easily. While the organs and tissues were all resting in this way, the body got rid of all the waste products which had been formed by the tissue cells during the day. Some of these waste products were got rid of through the lungs. The blood carried them to the lungs and from there they passed out into the air as we breathed. Some of the waste products were got rid of through the kidneys.

Then too while we slept the body cells took up from the blood, which flowed slowly around them, the food they needed to replace that which they had used up during the day. We can think of the tired cell as thin and weary at night and plump and refreshed in the morning after a good night's rest.

We should get enough sleep each night so that the body may have plenty of time to get rid of all the waste prod-

ucts formed during the day and to replace in the cells of the nerves and muscles the materials they used up while at work and play. If our sleep has been long enough, we wake up refreshed, feeling ready for another day's activities. If our sleep has not been long enough, we get up still feeling tired.

The body machine does not work well when the blood and organs are filled with waste products or when the tissue cells are tired and exhausted. Each morning should find the body free from the waste products and the cells refreshed, plump, and ready for work. To accomplish this, boys and girls from ten to fourteen years of age require about ten hours' sleep every night. Some need eleven hours. Sleep is even more important than food. We can go without food much longer than we can go without sleep. Young dogs have gone without food for as long as twenty days and lived, but when kept awake for five days they died.

Plenty of sleep is important, especially for growing boys and girls. Without enough sleep they will not be healthy, nor will they be able to do as good work at school. The boys and girls who get plenty of sleep will be the ones who will do the better work and do the best at play.

Questions

1. When the muscles work what do they use up? What do all the organs and tissues use up when they work?

2. When the muscles in working use up food what kind of products are formed?

3. Why are the waste products formed in the body like the ashes left in the furnace when coal or wood is burned?

4. When a muscle is worked what does it use up besides food brought to it by the blood?

5. What does it mean when a muscle gets tired?
6. Do nerve cells get tired? Why?
7. Do the brain cells get tired? What makes them tired?
8. Can the organs and tissues work well when they are surrounded by waste products? Why not?
9. Why do we get tired and sleepy?
10. What does the body do while we sleep?
11. What do the body cells do while we sleep?
12. How much sleep does one need?
13. Is sleep more important to us than food?
14. Can one do things better at night when tired or in the morning after a good night's sleep? Tell why.

CHAPTER XV

The Need for Regular Daily Habits

There are certain things we have to do each day. The two principal things we do are to sleep and eat. Other important things we do are to wash ourselves and brush our teeth. Then too most of us have chores to do at home.

If we do these things at the same time each day, the body gets used to doing them at that time and does them more readily and easily. In fact, the body gets so regulated to doing them that it will do them almost without our thinking about them.

Going to bed. — If we go to bed at the same time each night, our bodies get so that they are always ready for bed when the time comes. If we go to bed each night at nine o'clock, we soon find that each day as it gets near nine o'clock we feel sleepy, and we realize that our bodies want to rest and go to sleep, and going to bed becomes easy and pleasant. But if we stay up until ten or eleven o'clock for several nights, we find then that our bodies get out of the habit of going to bed at nine. They forget just when their bedtime is and do not seem to know just when to be ready for bed. And then instead of our bodies telling us when it is time to go to bed, we have to train them again to going at the proper time. It is so much easier to go to bed when our bodies are trained to going at a certain time. Then we fall to sleep much more easily and quickly.

Getting up in the morning. — The same thing is true of waking up in the morning as of going to bed at night. If we get up at the same time each morning, after awhile our bodies get so that they will wake up promptly at the proper time. If we get up each morning at seven, our bodies will soon get the habit of waking promptly at that time, and then getting up and washed and dressed is no trouble at all. We just do it without thinking. Our bodies do it because they have formed the habit. But if we get up sometimes at six o'clock, and sometimes at seven, and sometimes at eight, our bodies do not learn when it is time to get up and do not know when to wake. Someone will have to wake us, and even then we will probably not feel like getting up, but will want to sleep some more. It is much easier to get up at the proper time when we do it at the same time each day and our bodies get the habit. Then, too, by fixing the time we go to bed and get up each day, we can be sure that we get the proper amount of sleep, and it is important that growing boys and girls get enough sleep.

Eating. — Much the same thing is true of eating as of sleeping. We eat three times a day or perhaps four. If we eat at the same times each day, our stomachs get used to taking in food at these times and are ready for it. They do their part in the digestion of one meal and pass it along into the intestine, then rest awhile and get ready for the next meal. If we eat at the same time each day, we soon find that when meal time draws near we are ready to eat. We do not get hungry at other times. When we get hungry, it is our stomachs saying they are ready for food.

If we eat at different times each day, our stomachs do

not know when to be ready for food. They find that sometimes they are given a new supply of food to digest before they have finished with the preceding one, or perhaps that just as they have finished with one meal and are about to rest, they are set to work again. Our stomachs then do not know when to be ready for food, their work is interfered with, and they cannot take care of the food nearly so well. We should eat our meals at the same time each day so that our stomachs may get the habit of taking care of them in an orderly way.

Not only the stomach forms the habit of digesting the food given to it and passing it on in the alimentary tract regularly, but the whole alimentary tract, including the intestine, forms the habit of doing its work regularly if given an opportunity. The intestine completes the digestion of the food passed into it from the stomach and passes on what is left and cannot be digested. This accumulates in the lower end of the intestine, sometimes called the lower bowel. The intestine gets rid of this when we have a bowel movement. The body needs to get rid of this remains of our food regularly or it will ferment and decompose and do us harm. Just as we have certain times for our meals and train our stomachs to expect food at those times, we should have certain times when we empty our bowels, and should train them into the habit of getting rid of the waste from our food at those times. The bowel will form the habit just as readily as the stomach does. To train the bowel, all we have to do is to give it an opportunity to empty at the same times each day, either when we first get up in the morning or after breakfast or after some other meal. But to train the bowel, it must be given the opportunity to empty at

the same times each day. It will soon form the habit, and our whole alimentary tract will do its work better.

Washing face and hands. — If when we first get out of bed each morning we wash our hands and face, we soon get so that we do it without thinking. It becomes a habit, and if some morning we should fail to do it we would feel uncomfortable. We would know that something was wrong. We would find that washing our face and hands had become a pleasure and was necessary for our comfort. The same thing is true of washing our hands before eating our meals. We soon get so that we do not like to eat without washing our hands first, and do not like to handle our food unless we are sure our hands have been washed and are clean.

Brushing the teeth. — In nothing is the advantage of doing a thing at the same time each day truer than in brushing the teeth. If each morning when we first get up and again just before we go to bed we brush our teeth, we soon get so we do it without thinking. It is no trouble at all. If we fail to do it, we find our teeth miss it and our mouths do not feel right. It becomes one of the pleasant things we do and one of the things that makes us feel comfortable. Those who do not brush their teeth regularly do not learn the pleasure of clean teeth. Not only that, but teeth that are kept clean last much better than teeth that are not taken care of properly.

How regular habits simplify the things we do. — Training the body to do things at the same time each day causes it to do them much more readily and easily. It makes many of them pleasures. The body gets so trained it will do them without our thinking about them. It makes all the things we have to do easier and we can live our lives much happier and better.

Questions

1. Name some of the things you do every day.

2. Do you go to bed at the same time each night? Do you get sleepy at the same time each night?

3. Why should one go to bed at the same time each night?

4. Do you get up at the same time each morning? Do you have to be waked up or do you wake without being called?

5. Why is it best to get up each morning at the same time?

6. How many times a day do you eat? Do you always eat your meals at the same time? Why should one always eat one's meals at the same time? How does it help the stomach in its work?

7. Why should one have at least one bowel movement each day? How can the bowel be trained to empty itself at regular times?

8. Why is it best and easiest to do at the same time each day the things we have to do daily?

9. How can the body be trained to do things at the same time each day?

10. Does the body acquire habits readily? Does it acquire good habits as easily as bad habits?

11. What can you say about the habit of washing one's face and hands? Have you acquired the habit of washing your hands before each meal?

12. What can you say about the habit of brushing one's teeth?

CHAPTER XVI

The Skin and Its Care

The skin is the outer covering of the body. It protects the deeper tissues from injury. It keeps out of the body germs that would do the tissues harm. It helps keep the body cool in hot weather and warm in cold weather. Through it the body gets rid of much of its excess heat and some of the waste products formed by the muscles and organs as they work. The skin is an important part of the body, and our comfort and health depend upon its being kept in good condition and working properly.

The skin consists of two layers. The outer layer is called the *epidermis* and the deeper layer the *dermis*.

The epidermis. — The epidermis consists of many cells. The deeper cells are mostly round. The outer cells are flat and arranged much like the shingles on a house, but they are many layers deep. They protect the body and in places become very thick and hard, as in the palms of the hands and soles of the feet. The epidermis in the palms of the hands becomes still thicker in persons who do much work with their hands. The epidermis becomes thickened to protect the hands. In children who go barefoot, the epidermis on the soles of the feet becomes especially thick. This is to protect the feet from injury. There are no blood vessels in the epidermis. If there were, every little scratch would cause it to bleed.

The dermis. — Under the epidermis is the dermis, which is also sometimes called the true skin. It consists of a tough, strong network of what is called connective tissue, in which are many little blood vessels and nerves. In it are also the sweat glands and oil glands. The oil glands are called *sebaceous glands*. It also contains the roots of the hairs which grow on the body. Have you ever seen a fur rug made from the hide of an animal? The hide of an animal is its skin. The fur is the hair.

VERTICAL SECTION OF THE SKIN
Shows a sweat gland, oil glands and a hair. Notice also the blood vessels.

The sweat glands. — In the dermis or deep layer of the skin are the little glands called sweat glands. Each gland has a duct which extends up through the epidermis and opens on the surface of the skin. These are found in the skin of almost all parts of the body. In some parts, however, they are larger and more numerous than in others, as in the palms of the hands and on the forehead.

These glands secrete and pour out on the surface of the skin a clear, colorless liquid called sweat, which is mostly water, but contains small amounts of the waste products formed by the tissues of the body. These glands are at all times secreting small amounts of sweat. However the sweat usually evaporates as rapidly as it reaches the surface of the skin so that we do not notice it. It then merely

keeps the skin from getting too dry. When we get warm the glands secrete more, and then we can see it as moisture on the skin. A person may secrete as much as two or three quarts of sweat a day in warm weather. While the sweat carries off some waste products from the body, its main purpose, as we shall learn later, is to keep the surface of the body cool.

The oil glands. — The deeper layer of the skin also contains glands called sebaceous glands. Like the sweat glands these have ducts which pass up through the epidermis and open on the surface of the skin. These glands secrete an oily substance which covers the skin and serves to keep it from drying. They are especially abundant on parts of the body where there is hair, as on the head. Their secretion serves to furnish oil to the skin and to the hairs so that they will not become dry and brittle.

The secretion of these glands contains not only oil but also some broken-down cells from the glands themselves. If the ducts of the glands become blocked so that the secretion cannot get out, they sometimes become infected and form what are called pimples.

The hairs. — The skin also contains hairs. The roots of the hairs are located in the deeper layer of the skin. Hairs are present in the skin of practically all parts of the body except the palms of the hands and the soles of the feet. On some parts of the body the hairs are long and large, as on the head. On most parts of the body the hairs are short and fine.

How the skin protects the body from heat and cold. — Our organs and tissues are at all times forming heat as they work and burn up food, and at times they form a great deal of heat, as when we work or play hard. But no

matter how much heat is formed in the body, and no matter how warm or how cold the weather, the temperature of the body remains just about the same. It is chiefly the skin and its blood vessels that get rid of the excess heat formed in the body. It is also the skin and its blood vessels that keep the body from getting chilled in cold weather.

As has been explained, the deeper layer of the skin contains many small blood vessels. When the body has heat that it needs to get rid of, these blood vessels dilate and become larger, and as the blood flows through them it gives off its heat and becomes cooled. We can see this best in the face. When one becomes hot the cheeks usually get red. This is because the blood vessels in the skin of the face are dilated and full of blood. The blood in the vessels is what makes the face red. The blood has come to the surface of the body to get cooled.

When the weather is cold and the body wants to save its heat to keep warm, the blood vessels in the skin contract and become small so that very little blood can flow through them. In this way the body keeps the blood in the deeper tissues and away from the surface so it will not lose its heat. If when the weather is cold much blood flowed through the skin, it would become rapidly cooled and much of its heat would be lost. When the hands are exposed to cold they get pale because the blood vessels of the skin of the hands have contracted to keep the blood from getting chilled and losing its heat. The blood vessels in the skin of other parts of the body contract in the same way.

How the skin keeps the body cool in hot weather. — When the weather is hot and the skin becomes warm, the body would have difficulty in getting rid of its excess heat

if it were not for the help of the sweat glands. These glands are located, as we have learned, in the deeper layer of the skin, and pour out their secretion, called sweat, on the surface of the skin. When the surface of the body becomes too warm, the sweat glands become active and secrete large amounts of sweat which covers the surface of the skin with moisture. This moisture evaporates and in doing so cools the surface of the body. Whenever water evaporates it takes up heat and cools the surface it is on. When one's clothes are wet they always feel cooler. Sweating is simply the means the body uses to keep its surface cool. As long as the skin is cool, the body can get rid of its excess heat. When one has fever, the sweat glands secrete but little, the skin becomes dry and hot and the temperature of the body may become several degrees warmer than it is in health.

The care of the skin. — We have learned how the sweat glands are continually secreting sweat on the surface of the skin and how the sweat usually evaporates as fast as it is formed. What really evaporates is the water in the sweat. The waste products in the sweat do not evaporate, but for the most part remain on the skin. We have also learned about the oil glands in the skin and how they secrete oil containing broken-down gland cells. In this way the waste products from the sweat and the oil and broken-down cells from the oil glands accumulate on the surface of the body unless we wash or rub them off.

We wash our hands to get rid of the dirt on them that we can see, and to keep them free from germs and microbes which might get into our mouths when we eat and thus do us harm. For this reason we should always wash our hands before we eat. For the same reason we should

keep our finger nails clean. It is a good practice to clean the finger nails whenever we wash our hands.

When we wash our bodies all over we call it taking a bath. We bathe our bodies to wash from the skin the waste products left by the sweat and the broken-down gland cells secreted by the oil glands. It is just as important to wash the skin of our bodies as it is the skin of our hands, even if our bodies do not show the dirt as our hands do.

Bathing not only keeps the surface of the skin clean, but if we rub the skin well with a rough towel it also keeps the ducts of all the little skin glands from getting blocked up. Rubbing the skin with a rough towel after taking a bath is just as important as the bath. The rubbing does the skin good and makes it do its work better.

We should wash the skin of the body and rub it with a coarse towel at least twice a week. It is a good plan to do it every day if one can. It makes one feel better and is good for the skin.

When one takes a bath he should clean his toenails just as he cleans his finger nails when he washes his hands. The toenails get dirty just as the finger nails do.

The hair of the head should be washed from time to time, both to clean the skin of the head called the scalp and to clean the hair. It should be washed often enough to keep the scalp clean and the hair clean too.

Questions

1. How does the skin protect the body?
2. How many layers has the skin?
3. What is the outer layer called? What is the name given to the inner layer?

4. What can you say about the outer layer? Where does it often become very thick?

5. What does the inner or deep layer of the skin contain?

6. What can you say about the sweat glands? What do they secrete? What is its purpose?

7. What can you say about the sebaceous or oil glands of the skin? What do they secrete? What is its purpose?

8. How does the skin help keep the body warm in cold weather? How does it help keep the body cool in warm weather? How does sweat cool the body? What do the blood vessels in the skin do when the body gets cold? What do they do when the body gets too warm?

9. Why should one keep one's hands clean? Why should one wash one's hands before each meal?

10. Why does one need to wash the skin of one's body? What does rubbing the skin with a rough towel do, especially if done after taking a bath?

11. What can you say about the need for washing the head?

12. Why should one keep one's finger and toe nails clean?

CHAPTER XVII

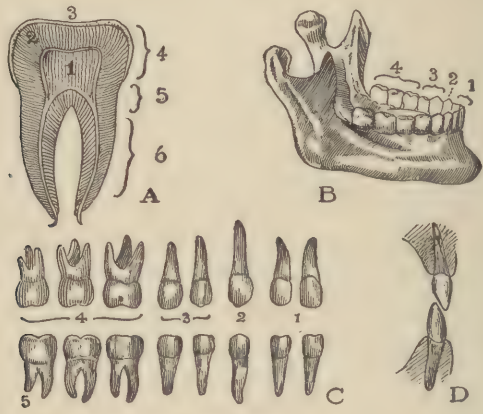
The Teeth and Their Care

When babies are born they have no teeth. However, when they are a few months old teeth begin to appear through the gums, first in front, and later at the sides, so that at about two years of age children usually have twenty teeth. These are called the first teeth, or sometimes the milk teeth. At six or seven years of age these teeth begin to get loose and come out. Usually one tooth loosens at a time, and in its place there soon appears another tooth. These second teeth that appear are called the permanent teeth, because they do not come out, but remain with us if we take proper care of them. They are the last teeth we shall ever have. When all of the permanent teeth develop there are thirty-two. If one should get injured or become decayed so that it has to be taken out, no other tooth will grow in its place. As we need teeth to chew our food, we should take such care of them that they will remain sound and healthy all our lives.

The structure of the teeth. — The teeth are hard, and in this they resemble the bones. Each tooth has a crown, which is the part we see projecting above the gums, and a root which extends down into the bone of the jaw.

The outside of each tooth is hard, but in the center it is hollow. The central cavity is filled with soft tissue, called the *pulp*. In the pulp are blood vessels and nerves which enter at the end of the roots. The hard part of the tooth

consists chiefly of bony material, called ivory or *dentin.* The outside of the crown of the tooth, which is the part we see, is covered with a very hard substance called *enamel.* The enamel is the hard substance that protects the teeth when we chew food. If it gets broken, the softer dentin of the tooth is exposed, and the tooth is liable to decay.



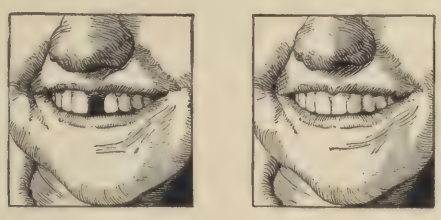
THE TEETH

A. Section of a single molar. 1. Pulp. 2. Dentin. 3. Enamel. 4. Crown. 5. Neck. 6. Root. *B.* Teeth in position in lower jaw. 1. Incisors. 2. Canine. 3. Bicuspids. 4. Molars. *C.* Upper and lower teeth on one side. 1. Incisors. 2. Canines. 3. Bicuspids. 4. Molars. 5. Wisdom. *D.* Upper and lower incisor, to show gliding contact.

The teeth have blood vessels and nerves in the pulp of their central cavities which (as was said) enter through holes in the ends of the roots. The blood feeds the teeth the food and nourishment they need just as it does the muscles and other tissues. The nerves of the teeth tell us when the teeth have been injured just as the nerves in our fingers tell us when our fingers are hurt. When we

have a toothache, it is the nerves telling us that we have a tooth that has been injured and needs attention.

Good health makes good teeth. — If our bodies are healthy and properly nourished, our teeth will be strong and healthy and not likely to become diseased and get holes in them. If the body is unhealthy, the teeth are likely to be unhealthy. We have explained how the body needs in its food certain vitamins and inorganic salts found in milk, leafy vegetables, and cereals. If the body



SHOWS HOW DIFFERENT ONE LOOKS WHEN ONE LOSES A TOOTH

does not get these things, the teeth are likely to suffer. The health of the teeth depends in a large measure upon the health of the whole body.

Teeth and gums need exercise. — We learned in a previous chapter that our muscles and organs all need exercise to keep them in good condition and make them strong. Our teeth need exercise to keep them healthy. The work of our teeth is to chew food. They get their exercise in doing this. Food that is tough and requires much chewing gives them plenty of exercise, while food that is soft, like mush or pudding or soft bread, gives the teeth very little exercise. If we eat nothing but soft food, our teeth will not get enough work to keep them in good

condition. They need some tough, hard food, like crusty bread and hard toast or crackers, to make them chew and get exercise. Work makes them strong.

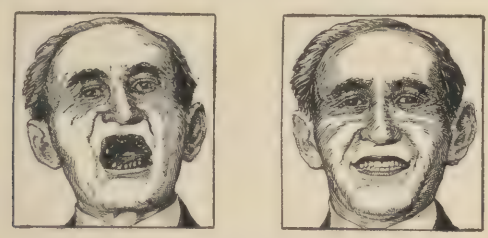
Teeth need to be kept clean. — When we eat, particles of food collect between the teeth and may stay there a long time. Starchy food, such as bread and crackers, is especially likely to lodge between the teeth and at the margin of the gums. This will in time ferment and form lactic acid, which attacks the enamel of the teeth and causes the formation of cavities. The food left between and around the teeth after eating should be removed either by rinsing the mouth with water or by brushing the teeth with a toothbrush. The teeth are best kept clean by brushing with a toothbrush after each meal. It is a good plan to brush them also just before going to bed, so that the teeth will be clean during the night.

The use of the toothbrush. — The toothbrush should not have too hard bristles or they may injure the gums. The brush should be rather soft. In using it the brush should be placed on the gums of the upper teeth and then moved downward so that the teeth are brushed downward. For the lower teeth the brush should be placed on the gums below the teeth and then moved upward so that the teeth are brushed upward. In this way the gums are not brushed away from the teeth. If we just push the brush backward and forward on the teeth, we are likely to loosen the gums from the teeth and push them back so that more of the teeth is exposed than should be. The gums are very important to the teeth and should cling closely to them. Anything that pushes the gums away from the teeth is bad for them. The inner sides of the teeth should be cleaned just as carefully as the outer sides. It

is a little more difficult, but it is necessary to keep them clean.

The toothbrush may be used with plain water, or a little mild soap may be used with it to clean the teeth, or tooth paste may be used. After brushing the teeth it is a good plan to rinse the mouth with plain water. The brush itself should be kept clean when not in use.

Proper use of the teeth. — The teeth are intended for chewing food. They should not be used to bite thread or crack nuts. The enamel is likely to get cracked and broken



WHICH DO YOU PREFER?

It pays to take care of one's teeth. Good sound white teeth look so much better. Then, too, one can chew one's food so much better with sound teeth.

if we do, and when the enamel gets broken the teeth are more likely to develop cavities. The teeth should be used properly and with care. They should not be used for purposes for which they are not intended.

Repair of the teeth. — When a tooth becomes broken or develops a cavity, it should be repaired at once before further damage is done. It is usually necessary to have a dentist repair it. If we do this, we will keep our teeth and they will remain useful as long as we live. When a tooth aches it usually means there is a cavity in it that needs

attention. It is a good plan for growing boys and girls to have their teeth examined by a dentist once or twice a year, even if they do not ache. If this is done, small cavities will often be found which can be easily filled, but which if not found would develop into large holes before one would know they were there. A small cavity is much easier to fill than a large one, and does not hurt nearly so much.

The best way to have strong healthy teeth is to have a strong healthy body properly nourished by the right kind of food. If we also give them proper use and exercise, keep them clean, and have any small holes that develop repaired at once, we will be sure of having good teeth with which to chew our food. And besides good bright white teeth look so much better than discolored or broken ones. Good teeth make us look better and feel better.

Questions

1. Of what use are our teeth?
2. How many sets of teeth does a person have?
3. What can you say about the first set of teeth? How many are there in the first set?
4. At what age do the second or permanent teeth begin to appear? How many of them are there when they have all grown out?
5. How do the teeth resemble bone?
6. What are the crowns of the teeth? What are the roots? What is the pulp? What is the enamel?
7. Where are the blood vessels and nerves of the teeth? What do the blood vessels do for the teeth?
8. When a tooth aches what is it the tooth's nerve is telling us?
9. Does having a healthy body help one to have good teeth?
10. How does the food one eats affect the teeth?
11. Do one's teeth need exercise? Why? How do the teeth get exercise?

12. Why do the teeth need to be kept clean? What is the best way to keep them clean?

13. How often should the teeth be brushed? How should the teeth be brushed? Why should one be careful not to loosen the gums from the teeth?

14. Why should one be careful not to break one's teeth? What can you say about biting thread or cracking nuts with the teeth?

15. What should be done when a tooth gets broken or has a hole develop in it? Why?

16. Why is it a good plan to have one's teeth examined by a dentist once or twice a year?

17. Why do we want our teeth to remain in good condition as long as we live?

CHAPTER XVIII

The Eyes and Their Care

Our eyes are very important parts of our body. With them we see the world about us, we see the trees, the flowers, the smiles of our friends, and all the many beautiful things with which we are surrounded. The eyes are the windows of the body through which we look out. With good healthy eyes we see things clearly as they are. If the eyes are injured in any way, we may not see so well or so clearly.

We see things only when there is light. We do not see in the dark. The eye is much like a camera. Light reflected from whatever object we are looking at enters the eye and strikes the back part of the eye, called the *retina*. Then we see the object. It is the light which enters the eye that causes us to see. The light enters through that part of the eye called the *pupil*. You will notice that if you look at a bright light the pupils of your eye contract and become small. This is to shut out as much of the light as possible, for bright light shining directly into the eyes is harmful. In a dim light the pupils get large so that more light will enter the eyes and we can see. In this way the eyes can protect themselves to some degree from too strong light and help us to see in dim light. But in spite of this, if the light is very bright it may injure the eyes, and if we try to read or look at small objects in a dim light we may hurt our eyes. The eyes therefore need

to be protected from too strong light, and should not be used for reading or fine work when there is not enough light to see well.

Reading and studying. — In reading and studying we should not face a window or a bright light. The window or light should be behind us. It is best and most convenient for a right-handed person to have the light come over the left shoulder and illuminate the book he is reading or his work. For this reason the principal windows in a school room are at the back. For this reason, too, the blackboard is put where the pupils when they are looking at it will not have the light from a window shining in their eyes.

Our Eyes Are the Windows of Our Bodies

Through them we look out and see the world about us.

One should read only when standing or sitting, and the book or work should be so placed that it can be seen easily and comfortably. Usually the thing we are reading should be held about fourteen inches, that is, a little more than a foot, away from the eyes. If we attempt to read while lying down, the light from the book enters the eye in an unnatural direction and reaches the retina at a place not usually used. The result is the eyes are easily tired and strained, and they may be harmed if much reading is done in this way. If one attempts to read on a street car or railroad train, he will find it tires the eyes. The reason is that on the street car or train there is jarring and

vibration, and the book or whatever one is trying to read is constantly shaking. In order to read under such conditions, the eyes have to keep following the slightly shaking page. They find this hard work, and as a result soon get tired. If we want to keep our eyes in good condition we should not read while lying down or while on a moving street car or railroad train.

The eyes, like our other organs, work best when the whole body is healthy and strong. When the body is sick, the eyes tire more easily than when it is in health. When ill therefore we should be especially careful not to overwork them. It is also true that the eyes can work better when the body is rested than they can when it is tired. They work better in the morning when the body is rested by a good night's sleep than they do at night when the body is weary.

Books with fine print are harder on the eyes than those with larger print. Shiny paper is harder on the eyes than paper that is not shiny. The books easiest on the eyes are those with good-sized print on white paper without any shine. In reading or doing fine work it is a good plan to look up and away from the book or work every little while. This rests the eyes.

Not all eyes see well. — We have learned the eye is like a camera. Those who have used a camera know that it has many parts and that if the parts are not arranged just right, and particularly if the camera is not focused properly, it will not take clear pictures. Unfortunately some people are born with eyes that do not focus properly, and as a result they do not see clearly, or at best see with some difficulty. Some people who are born with eyes that are good cameras injure them by improper use so that

they cannot focus well. Such eyes may see near things well but not objects far away, or they may see far objects but not small things close at hand. Those who see far objects best are said to be *far sighted* and those who see near objects best *near sighted*.

Eyes that do not focus well can be helped greatly by the use of properly fitted glasses. Any boy or girl who does not see well when he reads a book, or who has to bring the book close to his face to see the print, or who cannot easily see writing on the blackboard should have his eyes examined to find out what is the matter.

Sometimes people seem to see all right but they have headaches whenever they use their eyes to read or study. This is because their eyes focus with difficulty, and a little work tires them. If these people get the right kind of glasses, the glasses help the eyes to focus easily, and then they can use their eyes without tiring them and without getting a headache.

We can have but one pair of eyes. — We can have but one pair of eyes. Those we have must do us all our lives. If they are injured in any way by accident or improper use, we cannot get new ones. Our eyes are so important to us, being the windows through which we look and see the world about us, and being able to see well adds so much to our usefulness and our pleasures, that it is important to keep our eyes in just as good condition as we can.

Questions

1. What do our eyes do for us?
2. Can you tell how we are able to see things?
3. Why can one not see in the dark?
4. What do the pupils of the eyes do when a bright light shines into them? What do the pupils do when the light is dim?

5. In what kind of light can the eyes see best?

6. From what direction should the light come when one is reading or studying? Can you tell why?

7. How far from one's eyes should a book be held when reading?

8. What can you say about reading while lying down?

9. Why does reading on a train or street car tire one's eyes?

10. What kind of print is easiest to read? What kind of paper should be used in books?

11. How can one rest one's eyes while reading or working?

12. Why do some people need to wear glasses?

13. Why should one be careful and not injure one's eyes?

14. If one's eyes get tired and ache after one has been reading or studying what is usually the matter? What should be done?

CHAPTER XIX

Why We Wear Clothes and the Kind We Need

The body needs protection from the sun in summer and from the rain and cold in winter. For this purpose we wear clothes. In summer when the weather is warm and the sun hot, the clothes need to be of a kind that will protect the body from the sun but will let the body-heat escape. Light colored clothes protect the body best from the sun, because they reflect the sun's rays, while black clothing absorbs them. For this reason white clothing is cooler than dark or black. Linen and cotton clothing let heat pass through them better than does woolen. The coolest and most comfortable clothing in warm weather is therefore light-colored or white cotton or linen garments.

In winter we need clothing that will keep the body-heat from passing away from the body. Woolen garments do this best because they are poor conductors of heat, and the body heat is held in by them and cannot escape. Several thin garments protect the body from cold better than one thick one because under each garment there is a layer of air, and air confined in this way between the clothing is also a poor conductor of heat and serves to prevent the escape of the body's warmth.

The clothing worn next the skin absorbs the perspiration given off by the sweat glands. In this way, especially in warm weather, it becomes filled with sweat and the waste products in the sweat. For this reason our undergarments

need frequent changing. In summer they need changing and washing more often than in winter. All our garments in time become soiled by use and by the perspiration which the body is constantly giving off and need washing or at least cleaning and airing. The body can be kept clean only when the clothing is also clean. Garments taken off at night should be so hung up that they will air while we are sleeping.

THE SHAPE OF THE NATURAL FOOT

Our clothing should be so shaped that it will not interfere with the movements of the body and the action of our muscles. It should be so made that the legs and arms can be freely used in work and play. It should be loose enough so that it does not compress the body.

Shoes. — Shoes are worn to protect the feet from injury as we walk and run in our play and work. Shoes should fit the feet comfortably. If they are too narrow or too short or not the right shape, they will press the bones of the feet, and especially the bones of the toes, into unnatural positions. Improperly shaped shoes not only hurt and cause corns and bunions to develop, but in time they will actually deform and cripple the feet.

The natural-shaped foot is shown in the adjoining picture. The extent to which the feet may be deformed by incorrectly shaped shoes is also shown. If an X-ray picture is taken of the deformed foot, we find that the bones of the toes are bent into unnatural positions. This is shown in the picture on page 101.

To be comfortable, shoes must not be too narrow or too short. When one stands with his weight on his feet, they flatten out and become larger and broader. In try-

ing on new shoes one should always stand with all the weight on one foot so as to see whether the shoe is long and broad enough. The shoe should be at least half an inch longer than the foot, for the big toe always pushes forward in walking and running. In trying on new shoes both the right and left shoe should be tried on, because sometimes both shoes are not just alike, and sometimes one foot is larger than the other.

FEET DEFORMED

By wearing shoes that do not fit. One cannot walk or run well on feet crippled in this way.

The natural foot is much more useful and looks better than a foot deformed by badly shaped shoes. The natural foot is stronger and is better for walking and running.

Questions

1. Why do people wear clothes?
2. How do clothes protect our bodies from the sun?
3. What color of clothes protects us best from the sun?
4. What kind of clothing is coolest in warm weather? Why?
5. What kind of clothing keeps the body warmest in winter? Why?
6. Why do several layers of thin clothing keep the body warmer than one thick garment?
7. Why does the clothing worn next the skin need frequent changing, especially in warm weather?
8. Why should clothing not be tight or so made that it interferes with the use of the arms and legs?

9. Why do people wear shoes?

10. What happens to one's feet if one wears shoes which are too tight or are not the proper shape?

11. In trying on new shoes why should one always stand up and walk about with them on? Why should one try on both shoes? How much longer than the foot should the shoe be? Why?

12. Why is it important not to cripple one's feet with improperly fitting shoes?

CHAPTER XX

Microbes, Good and Bad

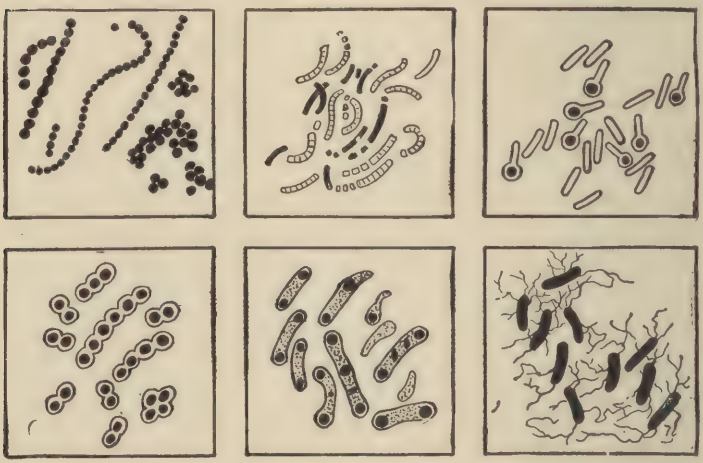
All about us we find plant and animal life. The trees and shrubs and vegetables we recognize as plants. Among the animal life we know are domestic and wild animals, fish, and insects. All of these we have seen.

We have learned that the human body is made up of little cells. Plants and animals are also made up of cells. The plants are made up of plant cells and the animals of animal cells. The bodies of the animals and plants we see are made up each of many thousands or millions of cells. But there are plants so small they are made up of a single plant cell, and there are forms of animal life so small that they consist of a single animal cell. These minute living things are so small they can be seen only by the use of a powerful microscope, and we call them microbes. Sometimes they are spoken of as germs.

The plant and animal microbes are very much alike, and it is often difficult to tell whether a microbe is an animal or a plant. It was only after man had learned how to make powerful microscopes that it was discovered there are such things as microbes. The first microbes were seen by the use of a microscope about the year 1700. We now know the living things in the world are not only the plants and animals we see about us, but also the microbes we cannot see except by the use of a microscope.

Where microbes come from. — It was at first thought

by many that these minute living bodies which were found in dirty water, milk, and decaying things must develop from the substances in which they were found. These people thought that when meat decayed it formed microbes. It was soon found, however, that decaying things did not form microbes, but that all microbes came from other microbes. It was found that, if all the microbes



DIFFERENT KINDS OF MICROBES

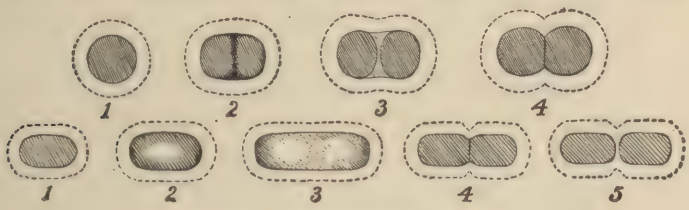
As they would appear through a powerful microscope.

on meat were killed and no more allowed to get on it, the meat would not spoil and decompose, and that if all the microbes in milk were killed and no others allowed to get into it, the milk would not sour. Then people knew that it was the microbes that made the meat rot and the milk turn sour.

It was also found that there were many different kinds of microbes and that each kind grew only from others of

the same kind, just as oak trees always come from acorns which have grown on other oak trees, as walnut trees always grow from walnuts which have grown on other walnut trees, as wheat grows from wheat, barley from barley, and chickens from the eggs of other chickens and robins from the eggs of other robins.

How microbes grow and multiply. — If microbes live in milk, they get their food from the milk. A microbe grows to full size, then usually divides into two parts. Each part then consumes food, grows to full size, and divides



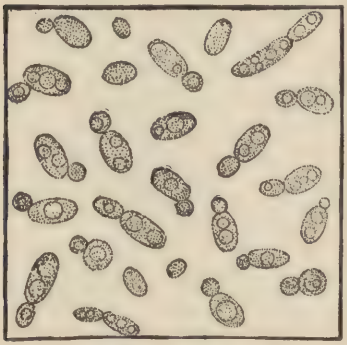
SHOWING HOW MICROBES MULTIPLY

Each microbe as shown here is dividing into two. Each of these will then grow to full size and again divide into two.

into two. Each of these grows and divides. In this way under favorable conditions a microbe may grow to full size and divide into two in fifteen or twenty minutes, and in another fifteen or twenty minutes each of these two will have divided into two, thus making four. In another twenty minutes there will be eight and in another sixteen. In this way one microbe may become many millions in a day.

Some of the microbes live in the earth, some in water, some on plants, some on animals, and some only in animals. Many are useful and may be said to be "good microbes." Others do injury to plants or animals or man and are "bad microbes."

Good microbes. — Many microbes live in the earth and by their presence make it possible for plants to grow. If it were not for the presence of these in the soil, we could not grow our farm products, wheat, oats and hay, or our vegetables and fruits. Farming would be a failure if it were not for the help of these good microbes.



YEAST MICROBES
As seen through a microscope.

The yeast used in making bread is filled with a certain kind of good microbe which grows and in growing gives off a gas which fills the dough with bubbles and causes it to rise. When the bread is baked, the yeast microbes are killed, but they have done their work and made the bread light and full of holes.

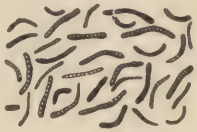
The pleasant taste of butter is due to the action of microbes which were in the milk from which the butter was made. The bad taste of some butter is caused by other microbes which have got into it. The flavor of different kinds of cheese is due to certain microbes used in making them. Vinegar is made from apple juice, but it is certain microbes that do it by forming acid in the apple juice. Thus they give us our vinegar.

If, when an animal dies, its body is left in the woods, it soon begins to decay or decompose. In time it disappears, and there is left only the hard, chalky bones. It is certain good microbes that decompose these dead animal bodies. Were it not for them, dead bodies would not

decompose, but the woods and fields would be filled with them.

The same thing happens to plants and trees that die. They rot and disappear. It is good microbes that cause them to rot. If it were not for this, the woods and fields would be so covered with dead plants and trees that there would not be room for others to grow.

When microbes decompose dead bodies and dead plants they change them into substances which go back into the earth and enrich the soil. A tree grows and in growing takes from the soil its food, plant food. This food taken



MICROBES OF TYPHOID FEVER MICROBES OF DIPHTHERIA

They are magnified about 1000 times larger than their real size.

from the soil makes the tree. The tree finally becomes old and of little use and dies. Then the microbes get to work and cause it to rot, and in this way the substances and food which the tree in growing took from the earth are returned to the earth and can be used again by other trees and plants.

Bad microbes. — But there are some microbes that live on living plants and animals and do them harm. Sometimes they live on the surface of the plant or the skin of the animal, and sometimes they penetrate deep into the plant or into the blood and tissues of the animal. When a living plant or animal is affected in this way by microbes which do it harm, we say it is diseased. The microbes

which cause diseases in plants are usually different from those causing diseases in animals. Some microbes will attack only one kind of plant and some only one kind of animal. Mildew and black spot on plants, distemper in animals, and measles and diphtheria in man are caused by bad microbes. Each disease is always caused by the same microbe. One microbe always causes mildew in plants. Another kind of microbe always causes measles in man, and still another kind always causes diphtheria.

Some microbes are among man's best friends, others are his worst enemies. Some help him grow his food. Some help him make bread, and cheese, and vinegar, but others he must fight and destroy wherever he meets them or they will destroy him.

Questions

1. What can you say about how the body is made up of cells? How small are these body cells? How many of them are there?

2. Are plants also made up of cells?

3. How many cells are there in the smallest plants? How many in the smallest forms of animal life? How can we see these smallest plants and smallest forms of animal life? What are they called?

4. What do oak trees grow from? What does wheat grow from? What do chickens grow from? What do robins grow from? What do microbes grow from?

5. How do microbes multiply? How many microbes may develop in a day from one microbe?

6. Where do microbes live? If a microbe lives in milk where does it get its food? If it lives on meat where does it get its food? If it lives in one's mouth where does it get its food? If it lives in one's lungs where would it get its food? Do all plants and animals have to have food? Why?

7. What can you say about how certain good microbes help the farmer? How do certain microbes help in making bread? In making butter? In making cheese? In making vinegar?

8. What do some microbes do to dead animals and plants? Why are these good microbes?

9. How do some microbes injure living plants and animals? What do we say of a living plant or animal which is being injured by microbes in this way?

10. Name a disease of plants caused by microbes. Name a disease of animals. Name a disease of man caused by them.

CHAPTER XXI

What Disease is and What it Means

When all the organs and tissues of one's body machine are working properly and as they should, one is healthy. But when one's organs or tissues have become injured so that they cannot do their work well, or when the body does not get the food it needs, or enough rest, or when one has taken into the body poisons that injure the organs or tissues, or when microbes get into the body and grow there and do injury to the organs and tissues, one is not well but is sick. Then we say the person has a disease. When the body machine is unable to do its work properly, we say it is diseased.

Diseases due to injury of organs. — Some diseases are due to improper use of parts of the body. One may overexert himself in a foot race and make the heart work harder than it can stand and in this way injure it so that for some time, perhaps for years, it will not be able to do its work well. Or one may eat food that the stomach cannot digest. If this is done often, the stomach may become so injured that it will not digest good food as it should. Or one may read much in a dim light, or with the sun shining on the book, or while lying down, and thus so injure the eyes that they will not work well. One may break his teeth by cracking nuts with them and have holes develop which unless cared for by a dentist will destroy the teeth. One may wear shoes that fit the feet

so poorly that the bones of the feet are forced out of place and one becomes crippled. All these things we can avoid by the proper use of our body machines.

Disease due to not giving the body the food it needs. — In a previous chapter we learned about the various kinds of food the body must have to supply proper nourishment to all the organs and tissues. We learned that proper food is especially important to the growing boy and girl. Young animals and boys and girls will not grow as they should unless they eat the kinds of food the body needs. The body cannot grow unless it is furnished the materials and substances out of which it can build tissue and make the body larger. To build a house you need lumber, bricks, mortar, laths, nails, shingles, window glass, putty, and paint. Likewise to build a body many materials are needed, and these we must get in our food. If one does not eat the materials the body needs, he not only will not grow, but he will not be well. He will not have the strength and energy he should have. One may eat a lot of food but unless it consists of the kinds the body needs he will not be well. He may even get very sick.

There are four diseases which make people very sick and are known to be caused by not eating the foods the body needs. These diseases are called scurvy, rickets, pellagra, and beriberi. You do not need to remember their names but should remember that one may become very sick unless he feeds his body the foods it needs.

Disease due to not getting enough rest. — If one does not get enough sleep, the body cells do not have an opportunity to become rested and restored after the day's work. If day after day one does not get enough sleep, the body cells get so that they are tired and fatigued all the time,

and in this condition they cannot do their work well. The brain suffers most, but all the organs do their work less well. Without sufficient sleep young animals, and also boys and girls, will not increase in weight as they should nor will their growth be as rapid as it ought to be. They may even lose in weight. People, young and old, who do not get enough sleep feel tired and are less cheerful and happy. They often become irritable and cross. And all because their body cells are tired and because they get too little sleep.

Disease due to poisons taken into the body. — Poisons are substances which when taken into the body injure the body cells. Some poisons, like carbolic acid, kill the cells whenever they touch them. Others, like phosphorus, may kill some of the body cells but they act more slowly. Others, like nicotin and alcohol, do not kill the cells but make them sick so that they do not work well. Many substances used as medicine are poisons if taken into the body in too large doses. The effect of a poison usually depends on the amount taken.

Nicotin is the poison contained in tobacco. People get it into their bodies when they chew or smoke tobacco, also when they use snuff, for snuff is powdered tobacco. Nicotin is a very powerful poison. Even in smoking one may get enough of it to make him very sick. It is especially injurious to young people.

Alcohol is another poison which does great injury to the body cells. It injures practically all the organs and tissues of the body. Even small amounts do some injury.

Tea and coffee contain a substance called *caffein*. It is used sometimes in small doses as a medicine. It has the effect of making one wakeful so that one will not get as much sleep as he needs. It also makes the heart work

faster. The result is that a person who drinks tea and coffee may not get enough rest and the heart may be overworked and he may become cross and irritable. Caffein, like many other poisons, is especially injurious to young animals. Tea and coffee therefore should not be drunk by growing boys and girls who want to keep themselves in good health.

Disease due to microbes. — It has been explained in a previous chapter that some microbes would grow in the body. Microbes to live and grow and multiply must have food, just as plants and animals do. Those that live in one's body must find their food there. Some microbes live in our mouths, where they find what they need to eat in the little scraps of food left around the teeth after meals. Some of these may injure the teeth, while some of them seem to do no harm. The cleaner we keep our mouths and teeth, the fewer of them there will be.

There are seldom many microbes in the stomach, because any that get there are usually killed by the acid in the gastric juice. The intestine contains many microbes. These find what they need to eat in our food as it passes through the intestine. Ordinarily the microbes in the intestine do no harm, although sometimes kinds get there which ferment the food and form gas or poisons which may do harm.

Other microbes when they get into the body live only in the blood and tissues, where the only food they can get is the blood itself and the body cells. If these microbes grow and multiply, as they sometimes do, so that there are a great many of them, they will do serious injury to the blood and body cells.

Microbes not only consume food, but they also give off

waste products and other substances, as do plants and animals. Most of the microbes which can live in the blood and tissues give off poisons; some of them give off powerful poisons. These poisons may make us very sick. One microbe of this kind that lives in the blood and tissues and gives off a powerful poison causes the disease we call typhoid fever. When this microbe gets into the body it grows and multiplies so that there may be millions of them. As they grow they give off a poison which makes a person sick. Another microbe which gets into the body and grows and gives off a poison produces a sickness we call measles. Another causes scarlet fever, and another smallpox. There are a great many diseases caused in this way. Each disease is caused by a special microbe and the same microbe always produces the same disease.

How the body fights the microbes. — When disease microbes get into the body, the body cells begin to fight them. First the white blood corpuscles or cells, called *phagocytes*, attack the microbes and attempt to devour them. They may be able to kill all the microbes, and if they do one does not get sick. But there may be too many of the microbes, or they may multiply so rapidly that the phagocyte cells can devour only a small part of them. Then the body cells begin making substances which will kill the microbes and other substances which will destroy their poisons. But it takes the body cells some time to do this, and before enough of the substances can be made the microbes may multiply to many millions, and their poison may make the body very sick.

When a person has fever and aches and gets weak, these things are caused by the poisons given off by the microbes. At this time the poisons are injuring the body cells, and

the body has not yet had time to form the substances which will kill the microbes and destroy their poisons.

When the sick person begins to feel better, it means that the body cells have formed these substances and the microbes are being rapidly killed and the poisons are either being destroyed or excreted from the body. It is fortunate the body has the power to form these substances, for if it did not, we should not get well when we had such diseases as measles, scarlet fever, and diphtheria. The microbes would destroy our bodies whenever we got these diseases.

When the body has formed these substances which kill the microbes, and the microbes have been killed, and the body recovers from the sickness, the substances still remain in the body, and as long as they do a person will not get the same disease again. This is because if any of the microbes should get into the body they would be killed at once by the protective substances there.

After some diseases these substances remain in the body a long time, sometimes as long as the person lives. This is true usually after measles, scarlet fever, and smallpox, and explains why when we have once had one of these diseases we seldom have it again.

After some diseases these substances remain in the body only a short time. This is true in the diseases we call "colds" and explains why we may have a cold every few weeks.

The substance which the body forms to kill the microbe of measles is different from the substance it forms to kill the microbe of scarlet fever. The substance formed is different for each kind of microbe. The substance which kills the measles microbe will not kill the scarlet fever or diphtheria microbe. An attack of measles therefore will keep our bodies from again having measles, but will not

protect them from other diseases, and an attack of scarlet fever will keep the body from again having scarlet fever but does not protect it from measles.

Questions

1. What is a healthy body?
2. What is meant by a diseased body?
3. How may the body machine become diseased by the improper use of parts of the body? How may the heart become diseased? The stomach? The eyes? The teeth? The feet?
4. What will happen to the body machine if one does not eat the foods the body needs? Why?
5. What will happen to the body machine if one does not get enough sleep? Why?
6. What are poisons? Name some.
7. What do poisons do to the body cells?
8. How do some microbes injure the body? Where do these microbes get their food? What can you say about the poisons they form? Name two diseases caused by microbes. Is typhoid fever always caused by the same microbe? Is the microbe which causes measles different from the one which causes typhoid fever? Is the one causing smallpox still a different one?
9. When disease microbes get into the body, what do the body cells do? What do the white corpuscles do? If the microbes continue to grow what do the body cells do?
10. When a person has a microbe disease, what is happening when he has fever and aches and feels sick? What does it mean when he begins to feel better?
11. What would happen when one got a microbe disease, if the body cells did not form the substances which destroy the microbes and their poisons?
12. When one has once had measles, scarlet fever or smallpox why does one seldom have the disease again?
13. Why can one have some diseases many times?
14. Do the substances which the body cells form to kill the microbes and destroy the poisons of one disease protect the body from other diseases?

CHAPTER XXII

Why Some Diseases Spread from One Person to Another

Many diseases spread from one person to another. Diseases which do this we say are "catching." All diseases which can spread from one person to another are caused by microbes. It is the microbes that are spread from the sick to the well.

How microbes leave the bodies of the sick. — In some diseases the microbes are not only in the blood and tissues, but there are many of them in the mouth, throat, and nose. This is true in measles and scarlet fever. In these diseases, when the sick person coughs or sneezes the microbes are scattered about and may get on anyone who is near at the time. Many of the microbes will be on the handkerchief used by the sick person. If others touch the handkerchief, they will get the microbes on their hands, and if they do not wash their hands carefully they may get the microbes into their mouths when they eat. If they are about the sick person when he coughs or sneezes, they may breathe in the microbes scattered by the coughing and sneezing.

Also, when the sick person drinks out of cups or glasses, and uses spoons and forks in eating, the microbes from the mouth get on the cups, glasses, spoons, and forks. If the microbes on these are not killed by putting them in boiling water, anyone who uses them may get the living microbes in his mouth, and then he may develop the disease. Even

when a person talks, he scatters about him microbes from his mouth. If the person has measles or scarlet fever, he will scatter the disease germs.

In diphtheria and also in common colds the microbes are in the mouth in large numbers and are scattered in the same way. Anything that the sick person puts in his mouth will get disease microbes on it. Cups, glasses, spoons, forks, chewing gum, toys, lead pencils, whistles, —

TWO KINDS OF MOSQUITOES

The mosquito on the left spreads malaria; the one on the right is harmless. Notice the different ways in which they stand.

all will be covered with microbes if put into the mouth of a person with one of these diseases.

In other diseases the microbes are not only in the blood and tissues, but also in the intestine. This is true in typhoid fever and cholera. In these diseases the microbes are contained in the bowel movements and leave the sick in this way. Anyone who gets typhoid fever gets it because he has got into his mouth microbes which have come from the body of some one else who had typhoid fever. This may happen in several ways. Flies in search of food may get at the bowel movement and get the microbes on their feet, then they may fly to another house

where people are eating and walk over the bread or other food, and wherever they walk they will leave the microbes of typhoid fever, and those who eat the food may get the microbes into their mouths and become sick with the disease.

Or the bowel movements may be thrown out on the ground and the rain may wash the microbes into a well. Then those who drink the water from the well may get the disease. These microbes often get into water, and sometimes into milk. This is why people should be so careful of the water they drink, and why city health departments watch so carefully the milk that is sold.

THE MOSQUITO THAT SPREADS YELLOW FEVER

The microbes of some diseases are only in the blood of the sick person. Malaria and yellow fever are diseases of this kind. In these two diseases the microbes are spread from the bodies of the sick to the bodies of the well by mosquitoes. The mosquitoes bite and suck blood from a person sick with one of these diseases, and then later bite well persons and in biting them inject the disease microbes into their bodies. In this way these diseases spread. If there are no mosquitoes, these diseases will not spread.

Whenever anyone gets sick with a disease caused by microbes, it is because he has gotten into his body microbes which have come from the body of someone who had the disease. Some of the microbe diseases are common colds, mumps, measles, whooping cough, scarlet fever, diphtheria,

chickenpox, tuberculosis, influenza, infantile paralysis, smallpox, malaria, cholera, yellow fever, and typhoid fever. There are many others. All diseases which are spread from one person to another are due to microbes.

Questions

1. When a disease is spread from one person to another, what is it which causes it to spread? What is it which is really spread from the one person to the other?

2. How are microbes spread from sick people to others when the disease microbes are in the sick person's mouth? How by coughing and sneezing? How by handkerchiefs? How by cups, glasses, spoons and forks?

3. Name a disease in which the microbes are in the sick person's mouth.

4. Name a disease in which the microbes are in the sick person's intestines. How may the microbes of this disease be spread from the sick person to others?

5. Name a disease in which the disease microbes are only in the sick person's blood.

6. How are malaria and yellow fever spread?

7. How do mosquitoes spread malaria and yellow fever from one person to another?

8. Will malaria spread from one person to another if there are no mosquitoes?

9. Name as many diseases as you can which are spread by microbes.

10. When a disease can be spread from one person to another, what is it due to?

CHAPTER XXIII

What we can do to Protect Ourselves from Diseases Caused by Microbes

Nobody wants to be sick. Everybody wants to keep as free from disease as possible. Some diseases so injure the body machine that it cannot keep on running. Life then leaves the body and the body dies. Other diseases do some injury to the body machine but not so much that it cannot keep on running. Each sickness and each attack of disease by doing some injury to the body shortens the time the body machine will be able to run. Each attack of disease in this way shortens the time the body will be able to live.

We can do much to keep our bodies from getting disease. By using the body properly, by getting enough sleep so it can have sufficient rest, by eating the food the body needs, by not injuring it with poisons, and by giving it the exercise it needs, we can help the body keep healthy and strong. This will even help keep the body free from microbe diseases, for some microbes cannot get a start in a body that is healthy and strong. There are some disease microbes however that can cause disease whenever they get into the body. The only way we can protect ourselves from the diseases caused by these is to keep away from the microbes, or at least not let them get into our bodies.

Keep away from the sick. — As people sick with mi-

crobe diseases have the microbes in their bodies and often in their mouths and on their handkerchiefs and on the bedding and other things about them, anyone going near the sick may get the microbes on him and possibly in his mouth. The best thing to do is to keep away from persons sick with such diseases unless, as sometimes happens, we have to be the nurse and take care of them.

Caring for the sick. — If one is taking care of a person sick with a microbe disease, his work is not only to wait on and care for the sick person, but also to keep the microbes from getting scattered about on things and from getting on other people. If the disease is one in which the microbes are in the sick person's mouth and nose, his handkerchiefs should be boiled, and the dishes from which he eats should be scalded with boiling water to kill the microbes. It is really better to use pieces of cloth instead of handkerchiefs. These can be burned. Flies should be kept out of the sickroom, as they may crawl on the soiled handkerchiefs, get microbes on their feet, and then fly to the dining room and walk over the bread and leave the microbes there. Whenever the nurse has handled the sick, or handkerchiefs or cloths used by the sick, she should wash her hands well with soap and water. It is a good plan to have a bowl of some disinfecting solution which will kill the microbes. The nurse can then dip her hands into the solution and be sure that all the microbes which were not washed off will be killed.

If the disease is one in which the microbes are in the sick person's intestine, the microbes in the bowel movements should be killed by putting in chloride of lime or carbolic acid, or some other substance which will kill them. No flies should be allowed to get into the sick room, or

they will soil their feet and carry the microbes to other people's food.

If the disease is malaria, all the mosquitoes in the room should be killed and none allowed to get in from outside. No mosquito should be allowed to get to the sick person, for if it does it may carry the microbes away and inject them into someone else and thus spread the disease.

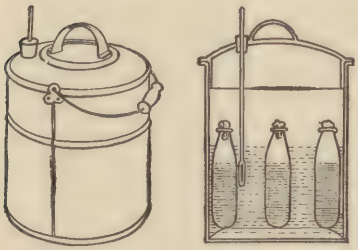
Keep flies away from your food. — Flies are unclean things. In their search for food they go to all sorts of places and walk in all sorts of things. They walk in the sputum of the sick, they crawl over the pus from running sores, they eat from bowel movements wherever they find them. Then they often fly to people's houses and walk over the food, and if their feet are dirty and have disease microbes on them they will leave them on the food. In this way many diseases are spread. In this manner we may get disease microbes from a sick person who lives some distance away and whom we have never seen. Flies are nasty things and dangerous. By keeping them away from our food and out of our houses we can help protect ourselves from getting disease microbes.

Foot of a House-Fly (Magnified)

Avoid drinking polluted water. — Microbes which live in the intestines frequently get into well water and into streams and rivers. In cities the drains from the bathrooms and toilets empty into the sewers, and the sewers frequently empty into the rivers. The sewage carries with it the microbes which come from the intestines of the sick as well as of the well. In this way river water fre-

quently contains disease microbes, and especially the microbes of typhoid fever. Typhoid fever is often spread in this manner. One should drink only water known to be free from pollution. Very often cities filter all the water supplied to the people. This is to get rid of the disease microbes. If one is in doubt as to whether water is safe to drink, the water can be boiled. This kills the microbes, and it is then safe.

Drink safe milk. — There are several disease microbes which, if they get into milk, will grow and multiply so that a few may become millions. This is true of the microbes causing typhoid fever, scarlet fever, and diphtheria. Often a person engaged on a farm in handling milk, or perhaps milking cows, will be just coming down with one of these diseases, or he may be just getting well from an attack. If in handling the milk his hands are dirty, or if he sneezes or coughs, microbes from his nose or mouth may get into the milk, where they will live and perhaps multiply. Then those who drink the milk will take the microbes into their bodies and many will develop the disease.



A Home Pasteurizing Apparatus

Then, too, cows frequently have tuberculosis, and the microbes of this disease often get into the milk. The only really safe milk is either boiled milk or pasteurized milk. When milk is pasteurized it is heated just hot enough to kill the disease germs but not hot enough to make the milk taste cooked. Properly pasteurized milk contains no

disease germs. Much of the milk sold in cities is now pasteurized.

Keep things out of the mouth. — Things which have been in the mouths of other persons have on them some of the microbes which have been in their mouths. People often stick lead pencils in their mouths. This should not be done, especially if others have used them. When others have used a cup or glass to drink from, there will be microbes on it from their mouths. Anyone drinking out of the cup or glass will get into his mouth microbes from the mouths of those who have used it before him. One should therefore not use common drinking cups or glasses used by others.

Protection by vaccination. — There are several diseases against which we can protect ourselves by vaccination. The most common of these are smallpox, typhoid fever, and diphtheria. We should all be vaccinated against smallpox, because it is such a dangerous disease and disfigures one so much. In places where there are many cases of typhoid fever, vaccination is perhaps the easiest and best way to protect ourselves against this disease, too.

Questions

1. What does disease do to the body machine?
2. Does every attack of illness damage the body machine?
3. When does the body machine stop running?
4. How do sickness and disease shorten one's life?
5. What can one do to keep from getting sick?
6. How do microbes cause disease?
7. How are microbe diseases spread?
8. What danger is there in going near a person who has a microbe disease?
9. Name some of the microbe diseases.

10. If one is taking care of a person sick with a microbe disease what should he do besides look after the needs of the sick person?

11. What precaution should be taken if the disease is one in which the disease microbes are in the sick person's mouth and nose?

12. What should be done with the handkerchiefs of a person sick with a microbe disease?

13. What would you do with the dishes used by a sick person who has a microbe disease?

14. What can you say about flies in a sickroom? Why are they dangerous?

15. Why should persons taking care of the sick wash their hands frequently?

16. When disease microbes are in the diseased person's intestines as they are in typhoid fever and cholera, what precautions should be taken with the bowel movements?

17. What precautions should be taken in a case of malaria? If there are any mosquitoes in the room what should be done? Why should all mosquitoes be kept away from the sickroom?

18. What do flies eat? How do they spread disease? How may they contaminate one's food?

19. What kind of disease microbes are most likely to get into water?

20. What disease is most often spread by drinking polluted water?

21. How may water always be made safe to drink?

22. Which disease microbes will grow in milk? How do these microbes get into milk?

23. What disease do cows have which people also have? Do the microbes of this disease get into the milk?

24. How may disease microbes in milk be killed?

25. Why should we not put into our mouths things which have been in other people's mouths?

26. What can you say of the practice of putting lead pencils in one's mouth?

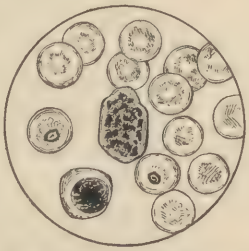
27. Why should we not use public drinking cups or drinking glasses others have used?

28. Against what diseases can one be protected by vaccination?

CHAPTER XXIV

Some Diseases are Spread by Insects

Certain diseases are spread by insects. Malaria and yellow fever are spread by mosquitoes. The mosquitoes bite the sick and suck their blood and with the blood suck up the microbes of these diseases. Later they bite healthy people and give them the disease. Typhus fever is spread by the body louse. The lice bite persons with typhus fever, then later get on the bodies of well persons and in biting them give them the disease. Plague is a disease which affects rats. The fleas on the sick rats get the microbes of plague in their stomachs when they suck the blood of the rats. Later they may get on people and in biting them give them this disease. House flies spread diseases, but they do it by getting microbes on their feet and legs from sputum and body excretions and carrying the microbes to the food people eat.



Shows Red Blood Corpuscles from a Person who has Malaria

The black spots are malaria microbes. Notice how they are living inside the red blood corpuscles.

Malaria. — Malaria is a very common disease in many parts of the world. It is one of the diseases which had to be controlled before it was possible to build the Panama Canal. It was so prevalent in the Canal Zone that most

of the workmen would become sick and many of them die. It was only by preventing this disease that the work could be carried on. The disease was controlled by killing as many of the mosquitoes as possible and by keeping those that were not killed from biting the men. This was done by screening the houses where the men lived so that the mosquitoes could not get in.

Malaria is spread only by the bite of mosquitoes. It was at one time a common disease in all parts of the

MICROBES OF MALARIA

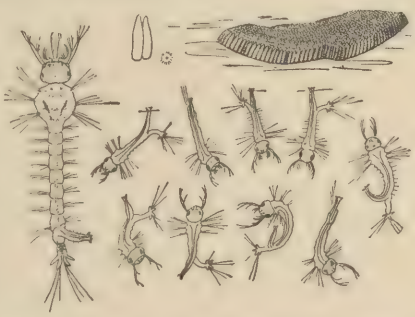
As seen through a microscope. These get into the blood by the bite of a mosquito and live in the red blood corpuscles.

United States. It is still a common disease in parts of the Southern States, and in some sections of California, and in certain of the Northern States.

Malaria in the United States usually does not cause people to die, but where it is common it keeps people sick. It keeps children sick and away from school. It makes men too sick to work. It makes many people just sick enough so that while they can do some work, they cannot do as much as they would like to do, nor can they do as good work as they would if they were well. It not only makes people sick, but it makes them live a shorter time

than they would if they did not have the disease, for like the microbes of other diseases, the microbe of malaria gives off poisons which injure the organs and tissues of the body so that they wear out sooner than they should.

There are many kinds of mosquitoes just as there are many kinds of deer. Some mosquitoes fly and bite mostly in the daytime, some fly and bite mostly at night. Some breed and lay their eggs mostly in cisterns and tubs and barrels of water about the houses; some lay their eggs in swamps and ponds. They all lay their eggs in water. Mosquitoes live only near where there is water in which they can lay their eggs.



SHOWS A MASS OF MOSQUITO EGGS ABOVE AND MANY WIGGLERS OR WIGGLE-TAILS BELOW

Mosquitoes seldom fly more than half a mile from the water in which they lay their eggs, and they seldom fly so far. A wind may carry them farther, but mosquitoes do not like to get caught in a wind and try to keep out of it.

The mosquito lays its eggs on the surface of the water. In a day or two the eggs hatch and out of each egg there comes a "wiggle-tail" or "wiggler," as they are called. These live in the water, swimming about in search of food, and coming to the surface every minute or two to breathe. They breathe air and have to come to the surface to get it. After living eight or nine days in the water, or sometimes longer, each "wiggle-tail" develops into a mosquito. In doing this it comes to the surface and the mosquito flies

away. These mosquitoes which develop from the "wiggle-tails" will bite people, and lay more eggs, which will make more "wiggle-tails," which will make more mosquitoes, and so they keep on until cold weather comes and kills most of them and keeps those that are left from laying eggs. This is the reason why in places where the winters are cold, mosquitoes are troublesome only during the summer. In places far south, like the Canal Zone, where the weather is warm all the year, the mosquitoes live and lay their eggs all during the year.

Not all kinds of mosquitoes spread malaria. The kind which spreads this disease is known as the *Anopheline* mosquito. It flies and bites mostly in the evenings and at night. It seldom bites during the daytime. It lays its eggs in ponds, swamps, and collections of water in the fields and woods. It is seldom found very far from such bodies of water. To protect ourselves from malaria we must keep these mosquitoes from biting us.

The best way to protect ourselves from malaria would be to kill all the mosquitoes if we could. They could be kept from laying their eggs and multiplying, if all the ponds and swamps in which they lay their eggs could be filled with earth or drained dry. Sometimes this can be done. Then the mosquitoes soon disappear. Sometimes the pond or swamp cannot be drained, but small fish can be put into it which will eat the "wiggle-tails" as fast as they hatch from the eggs. This prevents the "wiggle-tails" from developing into mosquitoes. Or sometimes crude oil or kerosene is spread on the surface of the water. This prevents the "wiggle-tails" from being able to get air to breathe and kills them.

But in places where malaria is present people can do

much to keep from getting the disease by carefully screening their houses. If houses are well screened the mosquitoes which come flying around at night to bite people will not be able to get in.

Where much malaria is present, it is likely to be the most serious disease which affects the people. It keeps people from being healthy and strong. Every one should do all he can to keep from getting it.

Questions

1. What insects spread disease?
2. What diseases are spread by mosquitoes? By body lice? By fleas?
3. How do mosquitoes spread disease?
4. How do flies spread disease?
5. How do people get malaria? Is malaria spread in any other way?
6. How was malaria prevented when the Panama Canal was built?
7. Is malaria a serious disease? Why? Does it kill many people? Does it shorten their lives? How?
8. What can you say about the different kinds of mosquitoes?
9. Where do mosquitoes lay their eggs? Do mosquitoes ever live far away from water in which they can lay their eggs? How far do mosquitoes fly?
10. When the eggs of mosquitoes hatch, what comes out of them?
11. Where do "wigglers" or "wiggle-tails" live? What do they breathe? How do they get air? How long do "wiggle-tails" live? What do they turn into?
12. What happens to mosquitoes and wiggle-tails when the freezing weather of winter comes?
13. What kind of mosquito spreads malaria? During what part

of the day does it do most of its flying and biting? Where does it lay its eggs?

14. How may one keep from getting malaria?

15. How are mosquitoes kept from multiplying? How are wiggle-tails destroyed? What is the purpose of destroying "wiggle-tails"?

16. Why should houses be screened in places where there is malaria?

CHAPTER XXV

Tuberculosis

Tuberculosis is a disease caused by microbes. The microbes may attack any part of the body. They often locate in a bone and cause the bone to become diseased. However, they most frequently attack the lungs and cause the disease known as pulmonary tuberculosis or consumption. About one tenth of all deaths are due to this disease. In the United States alone about 150,000 persons die of it each year.

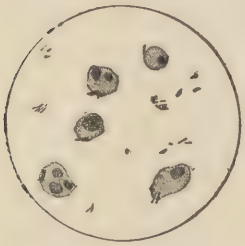
Where tuberculosis microbes come from. — Cattle have tuberculosis as well as people. The microbes of tuberculosis live in people and cattle which have the disease. Whenever a person develops the disease, it is because he has got into his body tuberculosis microbes which have come from the body of some person or of some cow which has the disease. Most cases in people are due to microbes from other persons, but about one case in every ten is due to microbes from cattle.

How the microbes get into our bodies. — When a cow has tuberculosis, the microbes often get into the milk, and people who drink it will get the microbes into their bodies. This is one of the reasons why all milk should be pasteurized to kill whatever disease microbes may be in it.

But most of the microbes which cause tuberculosis in people come from other persons. When people with consumption cough or sneeze, they often scatter the microbes

about them. Some people in talking scatter little droplets of saliva from the mouth. If a person with consumption talks or coughs with his mouth directed towards another person's face, he may actually scatter microbes on the other person's face and into the air he is breathing.

Persons with consumption usually cough up more or less sputum. The sputum usually contains tuberculosis microbes. If they spit the sputum on the sidewalk or in places where people walk, people will get it on their shoes and perhaps carry it into their homes and get it on the carpets or rugs. Or flies may walk in the sputum and get it all over their feet, then fly to fruit or bread or other food and wipe their feet on it. Or perhaps the fly will fall into a pitcher of milk or get stuck in the butter. If this happens, anyone who eats these things will get the microbes into his stomach.



MICROBES OF TUBERCULOSIS

As seen in sputum coughed up by a consumptive. The microbes are the small, threadlike spots and are as they appear through a microscope.

People with consumption often have the microbes in their mouths. When they drink from a cup or glass they may leave some of the microbes on it. If others use the cup or glass after them they will probably get the microbes into their mouths. This is one reason why we should not drink out of the common drinking cup so often seen in public places. It is better to go thirsty than to use such a cup.

What a sick person should do to protect others. — A person with consumption should never cough or sneeze

while facing another person. He should turn the head away and hold a handkerchief or piece of cloth in front of the mouth to prevent scattering the microbes all about. He should not talk with his face close to the faces of others. He should not spit where people can walk in the sputum nor where flies can get at it. It is better for him to spit into pieces of cloth or paper which can be burned or into a cup which he can carry in his pocket, if he wishes, and which can be either burned or emptied and disinfected.

People with consumption should not use cups or glasses which will be used by others. The cups, glasses, spoons, and forks which they use at meals should be scalded with boiling water after each meal. It would be well to scald also their plates and other dishes as well. Where there are children about they should be particularly careful, for children get the disease more readily than older persons do.

People with consumption may find it tiresome and somewhat of a nuisance to do all these things, but for the sake of those about them they love, and for the sake of others, as well, they should do them. No one would want to think he had given the disease to others, especially to a friend or some loved one.

What we can do to keep from getting tuberculosis. — There are so many people who have tuberculosis, and many of them are so careless in regard to coughing and spitting, that the microbes of the disease are constantly being scattered about. As a result most people at some time or other get the microbes into their bodies. Fortunately, if our bodies are well nourished and healthy, they are able to destroy a few of these microbes. If our bodies are not strong and healthy, however, they may not

be able to destroy them, and even a few of the microbes may be able to multiply and start the disease.

The surest way therefore to protect ourselves from tuberculosis is to keep our bodies strong and healthy. To do this we must eat the kinds of food the body needs, and must get enough outdoor exercise to keep the organs and tissues in good condition, and enough sleep each day to rest the body after its work and play. Sleeping outdoors or in a room with the windows open helps to keep the body healthy and strong.

But if we keep getting the microbes into our bodies, or if we get many of them at one time, we may develop the disease even if our bodies are strong and healthy. We should be very careful when we are around people whom we know have the disease, especially if they do not know the dangers and are not careful to hold a handkerchief or cloth before their mouths when they cough, and if they are careless about spitting.

Growing boys and girls should keep away as much as possible from those who have the disease and should keep their bodies healthy and strong.

Questions

1. What causes tuberculosis? What part of the body does it affect most often?

2. Do many people die of this disease? About how many people die of it each year in the United States?

3. Where do the microbes of tuberculosis live? How do people get tuberculosis? Can one have tuberculosis unless the microbes of the disease get into his body? Where do the microbes come from?

4. How do people get tuberculosis from cows? Where do people most often get the tuberculosis microbe?

5. How do people with tuberculosis spread the microbes to

others? If a person has microbes in his mouth what becomes of them when he coughs, sneezes, or talks loudly?

6. Should people talk into other person's faces? Why not?

7. Why is the sputum of a consumptive dangerous? Why should people not spit on the sidewalk or anywhere where people walk?

8. How may the microbes of tuberculosis be spread by common drinking cups and water glasses?

9. What should a person who has tuberculosis do to keep from giving the disease to others? What should they do when they cough or sneeze? Why? What precaution should they take when talking to other people? What should they do with their sputum? What should be done with the dishes from which they eat and especially those they put into their mouths?

10. Do children or adults get tuberculosis the more easily?

11. Can one's body destroy the microbes of tuberculosis? Do many people get the microbes into their bodies? Does it make a difference whether one gets a few or many microbes into one's body? Why?

12. Does a strong, healthy body destroy the microbes of tuberculosis better than one which is not strong and healthy? If a person with a strong, healthy body got a few microbes into his body what would probably happen to the microbes? If his body was not strong and healthy what might happen?

13. What can we do to protect ourselves from getting tuberculosis?

14. What is almost sure to happen if one keeps getting the microbes of tuberculosis into his body?

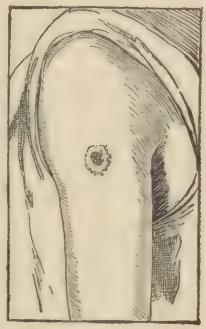
CHAPTER XXVI

Smallpox and Vaccination

Smallpox is another disease caused by microbes. It spreads very rapidly from person to person. Many years ago it was a very common disease throughout most parts of the world. Almost everyone had it at some time during his life. It caused the deaths of a great many people. Those who had it and got well usually had their faces and bodies badly scarred and disfigured. It was a disease every one feared.

In 1796, Edward Jenner, an English physician, showed that if a person was vaccinated with what was called cowpox he would not get smallpox even if he came in contact with people sick with the disease. This was a great discovery, because it made it possible for people to protect themselves from the dreaded disease. By the use of vaccination smallpox has now become a rare disease in many countries. It is still a common disease and each year kills many persons in those countries where the people have not been vaccinated. The disease will not spread in places where all the people have been vaccinated, and those living in such places do not need to fear it. For this reason the people in many countries are required by law to be vaccinated. In many places children are not allowed to attend school until they have been vaccinated. This is true in many parts of the United States, and as a result smallpox seldom occurs in these places.

Vaccination. — The outer surface of the left arm is the place usually chosen for vaccination. The skin is first cleaned with soap and water or a little alcohol. Then, when it becomes dry, a scratch is made with a clean needle or the point of a knife, and a drop of vaccine is gently rubbed into the scratch. Often two scratches are made about an inch apart. The scratch heals in a few hours, but after three or four days one or more little swellings appear at the place vaccinated. These get larger after a day or two more, and have little blisters on them filled with pus, and the arm about them becomes red and a little swollen. Later a dry brown scab forms. When this falls off a little scar is left. Usually about the seventh day after being vaccinated, when the arm is red and swollen, a person feels a little ill and has a little fever. This, however, lasts only about a day. It is an easy and simple way to protect oneself from such a serious and disfiguring disease as smallpox.



A Vaccination Sore

As it appears on the seventh day. This is what will protect you from smallpox. This scab will come off and leave a little white scar.

Being vaccinated once will protect a person against smallpox for several years. If one is vaccinated again after five or seven years, he will usually be protected for the rest of his life and need not be vaccinated any more. However, it is a good plan to be vaccinated again, if one is where there is much smallpox.

If every one in the world were vaccinated, smallpox would disappear entirely and cease to exist. It would then trouble us no more.

Questions

1. Have you ever seen a person who has had smallpox?
2. What causes smallpox?
3. Was smallpox ever a very common disease? Did it kill many people?
4. How can you tell a person who has had smallpox?
5. Who was Edward Jenner?
6. What did he discover? Why was his discovery important?
7. Is smallpox a rare disease now in many countries? Why?
8. Is smallpox still a common disease in some countries? Why?
9. Do people who have been vaccinated need to fear smallpox? Why not?
10. Why does the law in many countries require people to be vaccinated?
11. What part of the body is usually chosen for the vaccination?
12. How is vaccination performed?
13. Have you ever been vaccinated? If you have been, tell what happened to your arm. Did it make you feel sick at all?
14. Would you rather be vaccinated or run the risk of having smallpox?
15. How long will being vaccinated once protect one from smallpox?
16. When should one be vaccinated a second time?
17. How long will two vaccinations protect a person?
18. What would happen if everyone in the world could be vaccinated?
19. Do you think it would be a good thing to have everyone in the world vaccinated, if this could be done? Why can not this be done?
20. Would it be possible to have everyone in your city or town vaccinated? How would you have this done?

PART III

Hygiene of the Home

CHAPTER XXVII

The Home

To the Arab his tent is his home. The home of the savage may be a grass hut. The winter home of the Eskimo of the Far North is a house of ice and snow. With us our home is the house in which we live. It is where we mingle most with those we love. It is where we eat and sleep and visit with father and mother, sisters and brothers. It should be a place of happiness and health, a place where our body machines can get the things they need, — good food, pure air, and plenty of sleep. It should be a place where disease microbes cannot reach us.

If we live in a city, our home may be a number of rooms in a large building called an apartment, or flat, or it may be a house with a yard around it. If we live in a small town, it may be a house with a large yard, a barn, a woodshed, and a garden. If we are fortunate enough to live on a farm, the house will be surrounded with fields, and there will be stables and outhouses and perhaps an orchard.

The location of the house. — If one is selecting a house to live in, or if one is going to build one, the first thing to decide upon is the location. A house should be built where the land is dry. It should not be near swampy ground nor where puddles or pools of water form after rains. The best location is where the ground slopes away from the house in all directions. Then when it rains the water flows away from the house and leaves the ground about it dry. If the house were to be built in a hollow

where the ground sloped toward it, the water would collect around the house and some of it would undoubtedly run into the cellar and keep it wet and damp.

In cities the houses usually face the street, and in the country they are built to face the road. If the house faces north or south, east or west, the sun will shine into the windows of three sides at some time during the day, into the windows on the east in the morning, into those on the south during the middle part of the day, and into those facing west during the afternoon. But if the house is made to face northeast or northwest or southeast or southwest, the sun will shine into all the windows of the house. The windows on the sides towards the northeast and southeast will have sun during the morning, and those on the sides facing northwest and southwest will have it during the afternoon. It is best to have the house so that the sun will shine into all the rooms if one can. It makes the rooms brighter and more cheerful.

What houses are built of. — Most houses with cellars have the cellar walls made of brick or stone. Many houses also have the walls of the house built of brick or stone. But most houses in America have the house walls built of wood. It is best to have the cellar walls built of brick or stone, as this gives a solid foundation upon which to build the house, but for that part above the cellar, wood makes as good a house as any, except that it is more likely to catch on fire and burn than is a house built of brick or stone. Houses built of wood are called "frame" houses. Stone and brick houses are more likely to be damp than are wooden ones. Bricks and stone absorb water when it rains and will remain damp for a long time.

All houses are plastered on the inside to make the walls

smooth. It also makes the walls thicker and the house warmer. Plaster is made of sand and lime and sometimes with cement added.

The roofs of houses are built mainly to keep out the rain. They are slanted so that the water will run off rapidly instead of leaking through into the house. Wooden shingles are most often used to cover the roof. Sometimes slate is used. The pieces of slate are much like those used in school and are put on so that they overlap, just as is done with wooden shingles. Slate is not so likely to catch fire as are shingles. In some parts of cities they will not let people put wooden shingles on their houses because of the danger of fire. Often in cities the roofs are covered with sheet iron coated with tin and painted. These are called tin roofs. They have the advantage that they will not catch fire, but they get very hot in summer and may make the upper part of the house uncomfortably warm.

The cellar or basement. — The cellar is an important part of the house. It should be so built that it will keep dry. If it is damp, the house itself will be damp. If the cellar is built where the ground stays wet, tile drains placed in the ground outside of the cellar wall will carry the water away and keep it from running into the cellar.

If the house has a furnace for heating, it is usually placed in the cellar. The cellar also furnishes a place to store the fuel used in the furnace, — the coal or wood. Vegetables and canned fruits are also usually kept there. The cellar should be kept clean, and rubbish should not be allowed to collect in it. Rubbish in a cellar may catch fire and is dangerous for this reason. Besides, rubbish should not be allowed to collect in any part of the home. and the cellar is part of the home.

Questions

1. What is a home?
2. What is the Arab's home? The Eskimo's?
3. What should the home be?
4. What kind of land should a house be built upon? Which way should the ground slope, towards the house or away from it? Why?
5. What happens when a house is built in a hollow?
6. How can a home be built so that the sun will shine into all the windows during some part of the day?
7. Why would you like to have the sun shine into all the rooms?
8. What are cellar walls usually built of? Why?
9. What are houses built of?
10. In what way is a wooden or "frame" house better than one built of brick or stone?
11. What advantage has a brick or stone house over a "frame" house?
12. What is plaster made of? Why is it put in houses?
13. What are the roofs of houses made of? In what way are slate roofs better than those covered with wooden shingles?
14. Why should a house have a dry cellar? How can a cellar be made dry?
15. What are cellars used for? Why should they be kept clean?

CHAPTER XXVIII

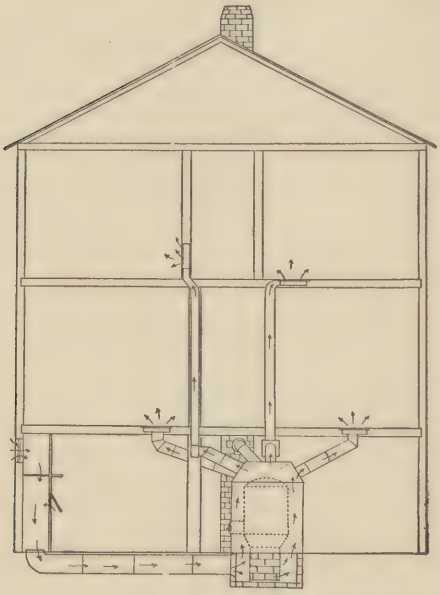
Heating the Home

Heating the home. — In the tropics and where it is warm all the year round, houses do not need to be heated. But in most parts of the United States it is so cold during the winter that some kind of heat is necessary. Some people use stoves to heat the house, some have hot air furnaces, some use steam, and some hot water.

Stoves. — Stoves furnish plenty of heat, but do not heat all the rooms. Usually the rooms in which there are stoves are very warm, especially near the stoves, while the other rooms may be cold. If there are several stoves in a house, it requires considerable work to keep them supplied with coal or wood and to clean away the ashes. For this reason most people prefer to have in the cellar a furnace which will heat all parts of the house and will make it necessary to take care of only one fire.

Hot air furnaces. — Many houses are heated by hot air furnaces. The furnace is placed in the cellar and is surrounded by a sheet-iron jacket. There is a space between the furnace and the jacket. When the furnace gets hot it heats the air in this space. Leading from this space, called the hot-air chamber, are large pipes which go to each room of the house. When air is heated it becomes light and rises, so that as the air in the hot-air chamber becomes warm it flows up the pipes and into the rooms above. The hotter the air the faster it flows. As the hot

air in the chamber flows up the pipes to heat the house, cold air flows into the chamber through a large pipe which lets in cold air from outdoors. This cold air is heated in the chamber around the furnace and then flows up into the house above. In this way fresh cold air from outdoors is constantly flowing into the chamber, and then being heated flows up into the rooms above.

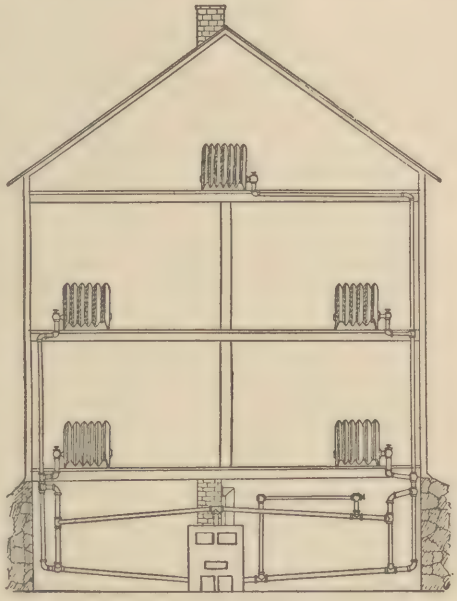


HEATING WITH A FURNACE — HOT AIR SYSTEM

Houses can be heated very well in this way, but the pipes which carry the warm air must be large enough and must slant upward or the warm air will not flow through them and some parts of the house will not be warmed. Sometimes when the wind is blowing from a certain direction it interferes with the flow of the warm air and makes it difficult to heat the house. A hot-air furnace costs less to put in than does a furnace which heats by steam or hot water.

Heating by steam. — In houses heated by steam the furnace is also usually placed in the cellar. While the hot-air furnace has a chamber in which air is heated and sent

through pipes to all parts of the house, the steam furnace has a chamber in which water is heated and changed into steam, and the steam flows through pipes to radiators in the various rooms. The steam heats the radiators and keeps them hot, and the radiators warm the house. The steam does not flow out into the air of the rooms as the hot air from the hot-air furnace does. The steam stays in the radiators, and when it becomes cold it changes again into water and flows back to the water chamber of the furnace. It is often easier to heat a house by steam than by hot air because the steam is under pressure and can be made to flow where it is wanted. However, as soon as the fire in the furnace gets low so that it will not make the water in the chamber boil, no steam is formed and there is no heat for the house. With a hot-air furnace there is some flow of warm air through the pipes as long as there is fire.



Steam-Heating System

Heating by hot water. — In heating with hot water the furnace has a chamber with pipes leading from it to

radiators in the rooms of the house just as when steam is used. But with hot-water heating the chamber and the pipes and the radiators are all filled with water. When water is heated it rises to the top just as air rises when it is heated. The result is that when the furnace heats the water in the chamber, the hot water rises up through the pipes and into the radiators so that the radiators become hot. As the water in the radiator becomes cooled, it flows back to the furnace through other pipes and is again heated. In this way the water is constantly flowing through the pipes. Hot water flows to the radiators, and the cooled water flows back to the furnace.

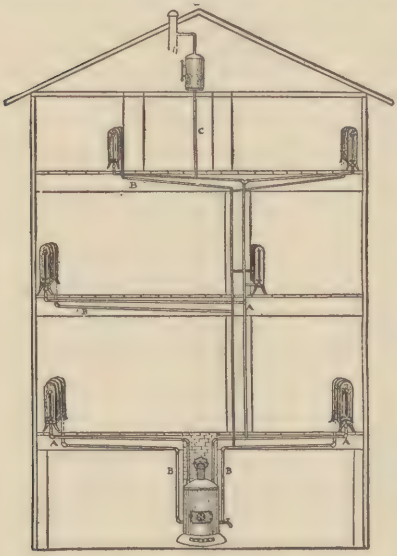


Diagram of Hot-Water Heating System

The pipes and radiators have to be larger when hot water is used than they do with steam, so that a hot-water heating system costs more than a steam-heating one. However, a hot-water system keeps a house at a more uniform temperature than does steam, because as long as the furnace fire is going the water stays warm. The water cools more slowly than steam. It takes longer to get a cold house warmed up with water than with steam, but once warmed it is kept warm more easily.

Houses should not be kept too hot. — People in America usually heat their houses much hotter in winter than do people in the countries of Europe. This may be because in America coal and wood are much cheaper and more plentiful than they are in Europe. Houses should not be heated too hot, because one is more likely to catch a head cold when one goes outdoors where it is cold after being in a house that is too warm. Breathing the hot, dry air of a house makes the mucous membranes of the nose and throat less healthy and less able to withstand and fight the microbes which cause head colds.

In order to keep a house properly heated and so one may know whether it is too cold or too warm, thermometers should be hung in the different rooms. If one has but one thermometer, it is best to have it in the living room or sitting room where the family gathers to visit or to read or to study. What is known as the Fahrenheit thermometer is the one usually used in America. The living room is the one that should be kept warmest, for this is where the members of the family spend most of their time when they are sitting quietly reading or talking. This room should be heated to from 68° to 72° as shown by the thermometer. This will be found comfortable. If it gets warmer than this, the air will be too hot and dry. The dining room where the family eats should be the same temperature at mealtime. Rooms where people are not sitting quietly need not be so warm as this. The bedrooms at night should be much cooler. In fact, in them the heat can be shut off and the windows opened so that during sleep the air breathed is cool. We sleep better when we have cold air to breathe, and we wake up in the morning feeling more refreshed.

The air in heated houses is dry. — The air in heated houses is usually very dry, drier even than desert air. In cold weather the air has very little moisture in it, for cold air will not hold moisture. When cold, dry, winter air is heated, as it is in our houses, it becomes exceedingly dry, and when we breathe it, it dries and irritates the membranes of our noses and throats. If we could only moisten the air, it would make us feel much more comfortable, and it would be pleasanter to breathe. When people heat their houses by stoves, they often place a kettle or dish of water on the stove, and as the steam passes off from this it helps to moisten the air a little. Hot-air furnaces have a small water tank connected with the hot-air chamber. This tank should be kept filled, as it gives some moisture to the dry, heated air. Sometimes cans of water are hung behind steam and hot-water radiators to give off moisture. All these things help some, but none of them make the air as moist as it should be. The hotter the air in the room is heated, the drier it gets and the more moisture it should have. This is one reason why we should not heat the air of our houses too hot.

Questions

1. How are houses heated? How is your school heated?
2. How warm should a house be heated? How warm is your school room heated in the winter?
3. Why should a house not be heated too warm? How does a too warm house make one more likely to catch a head cold?
4. Do you study better at school when the room is hot or when it is cool? Do you get sleepy when you study in a hot room?
5. What is a thermometer? Have you one in your school room?
6. Is heated air dry? How dry may the air in a heated house become? Do you like to breathe dry air?

CHAPTER XXIX

The Home (Continued)

The bedroom where we sleep. — We spend at least a third of our lives in our bedrooms sleeping. It is here we spend from eight to ten hours each day. The bedrooms should be cool at night. While sleeping the body should be kept comfortably warm with blankets and quilts if necessary. If too much covering is used, the body will be too warm and sleep will not be so refreshing. The head should not be covered, but should be out where cool air can be breathed. If the head is covered by the blankets, one breathes and rebreathes the same warm air over and over again. Not only is it best to have the head uncovered, but the windows of the room should be opened enough so that the air in the room is kept cool or even cold.

A Sleeping Porch

Many people sleep on open porches. People nowadays often build porches on their houses for sleeping. When we

have slept on a sleeping-porch we seldom ever want to sleep in a bedroom again except when the weather is very cold. One seems to sleep better on an outdoor porch and to wake up feeling more refreshed. Of course it is simply because the air is usually cooler outdoors and is constantly in motion, carrying away the air that has been breathed and bringing always fresh, cool air to the sleeper. If one has plenty of windows in his bedroom and keeps them open, he can have almost the same condition he would have on a porch, but most people who have slept on porches like it much better than sleeping in bedrooms.

The kitchen. — The kitchen is the room which is usually used more than any other in the house. It is here that the food is prepared and the meals cooked. In the kitchen a large part of the work of the house is done. Because it is used so much, the kitchen should be made one of the pleasantest rooms. It should have plenty of windows to give light and air. Instead of being the room to which least attention is paid, it should be planned with the greatest care. The stove and sink and tables should be so placed that they will make the work in the kitchen as easy as possible. The icebox and pantry where the food is kept should be where they can be reached conveniently. As the food is prepared and the meals cooked in the kitchen, everything should be so arranged that the room can be easily kept clean.

The kitchen is the housekeeping workshop. The pans and dishes and cooking utensils are the tools. Every good workman takes pride in his tools and shop and keeps them in the best of condition. Every good cook properly takes pride in her kitchen and the utensils which are her tools. The work of preparing food for the family so that

it will be pleasant to eat and easy for the body to digest is as important as any work one can do, and the ability to do it is a great accomplishment.

Screening of windows and doors. — Flies are a nuisance and carry microbes on their dirty feet, and mosquitoes bite and annoy one even where they do not carry malaria. For this reason a house should have all the windows and doors covered by screens to keep out these insects wherever they are present. In hot climates flies and mosquitoes are present during all the year. In most parts of the United States, however, they are present only during the summer and disappear after the first freezing weather in the autumn.

The screens should be made to cover the windows, and the door screens should be made so to fit the doors that neither flies nor mosquitoes can get in. Cloth netting is often used to cover windows. It will keep out flies, but usually the meshes are so large that small mosquitoes can get through them. Cloth netting is likely to get torn and soon wears out. Many use netting of iron wire painted. This rusts and holes form in it after it has been used for a year or two. A better netting and one which lasts longer is made of galvanized iron wire. Galvanized wire is iron wire coated with zinc. The netting which lasts longest is made of copper or bronze wire, but this is quite expensive and often costs so much it cannot be used. However, it will last many years, and because it lasts so long is often really the cheapest.

Any of the kinds of netting used will keep out flies, but some of them have meshes so large that small mosquitoes can get through, especially the small mosquitoes which carry malaria. Where there is malaria the holes of the

screen should be small, not larger than one eighteenth of an inch across. Screens as fine as this will have eighteen meshes to the inch. Some screens are made with meshes as large as one twelfth of an inch across. These are large enough to let mosquitoes get through them. Flies and mosquitoes are our enemies. They endanger our health. The house is a place for the family to live in, and all dangerous insect enemies should be kept out.

Lighting the home. — A house should have plenty of windows. Every room should have at least one window and if possible two or three. The windows let in light during the day. The more windows there are, the lighter and more cheerful the house will be. In warm weather the windows can be opened to let in the breezes and cool the home.

The sun lights our houses during the day, but when it gets dark at night we have to have some other means of lighting. Otherwise we would have to go to bed before it got dark. Years ago people had only candles to light their houses, but now we have lamps which burn kerosene, and people in the cities have gas and electricity. Whatever form of lighting is used, when we are reading or studying the light should shine on our book so that we can see the type easily. It should not shine into our eyes. If it does it will tire them. It is better to have the light shine over the left shoulder on to the book, or if the light is in front of us on a table, it should be so shaded that the light itself cannot be seen.

Daylight tires the eyes less than artificial light does, so we ought to do as much of our studying as possible during the daytime, but when the days are short and the evenings are long, as they are during the winter, we have to do some

of our reading at night. However, in reading and studying we should always think of our eyes and make sure the light is good, for we can never have but the one pair of eyes.

Questions

1. How many hours a day do you spend in bed? How much of your lifetime do you spend in bed?

2. What kind of air should one breathe while asleep? Does a bedroom need to be heated? Do you have your bedroom windows open at night? Do you like them open? Do you feel better in the morning when you have slept in a cool room or in a warm one?

3. What happens if one covers one's head at night with blankets or quilts? Why should one not do this?

4. Why do some people sleep on sleeping porches?

5. Is the kitchen an important part of the house? Why? Why is the kitchen the home workshop?

6. Why should a house be screened? What is used for screening?

7. What kind of screening do you think is best?

8. How fine does screening need to be to keep out the mosquitoes which carry malaria microbes? How many holes or meshes to the inch should it have? How would you tell how many meshes there were to the inch in a screen?

9. Why are windows built in houses? What purposes do they serve?

10. How are houses lighted during the day? How are they lighted after dark?

11. Why do we need to have our houses lighted?

12. When we are reading or studying how should the light shine on our book? Do you like to face a light? Does it hurt your eyes? Can you read better when the light is back of you and shines over your shoulder?

13. Can one read more easily by daylight or by lamplight? Which tires the eyes more?

14. When should one do as much of his reading or studying as he can?

CHAPTER XXX

The Home (Continued)

The floors of the house. — The floors of houses are made of wood. Usually narrow boards are used which fit closely together and make a smooth floor with the narrowest possible cracks. The smaller the cracks the better. Some floors are so well made they have no cracks at all. Floors without cracks are much easier to keep clean, for when there are cracks, dirt gets into them and cannot be swept up. Soft wood, such as pine, is often used for floors, but many use hard wood, such as oak and maple. Floors made of hard wood last longer and keep in better condition.

Some people have their floors bare, but many cover them with carpets or rugs. Bare floors are easier to keep clean, but carpets and rugs make the house quieter so that one does not make so much noise as when walking over a bare floor. However, carpets and rugs collect dirt. Often we bring dirt into the house from out of doors on our feet. This gets into the carpets, and in time they become very dusty and have to be cleaned. For this reason many people use on their floors rugs which can be easily taken outdoors and swept and dusted. If carpets are used and are tacked down to the floor, as they often are, it is very difficult to take them up and clean them. Many people prefer to use rugs for this reason.

Care of Garbage. — In the preparation of food there

is always some waste, such as the parings of potatoes and other vegetables, egg shells, and the skins of fruit. The waste parts of food are called garbage. On a farm it can be fed to chickens and hogs, but in cities this cannot be done. It cannot be thrown into the yard, for it will attract flies and rats, and in warm weather it will get "smelly" and unpleasant. It can be wrapped in paper or be put in a paper sack and burned in a fire. But this is not always convenient, especially in summer, when the only fire is the one in the cook stove. Another way to get rid of garbage is to bury it in the ground.

In all the larger cities and in many of the smaller ones the city employs men to go around to the houses and get the garbage and carry it away. These men call at the houses once or twice a week in winter and usually oftener in the summer, sometimes every day. Each house has to have something in which to keep the garbage until it is called for. Whatever it is kept in should be water-tight and have a tightly fitting cover so that flies, rats, cats, and dogs cannot get to it. If it is left open, it will attract flies and rats to the house. If dogs and cats can get at it, they will very likely upset it and scatter it about the yard. Galvanized iron cans with tightly fitting covers are made for holding garbage and are used by most people. In buying such a can one should be sure the cover fits so well that flies cannot get into the can and that dogs cannot knock it off.

The men who are employed by the city to collect the garbage from the houses usually have wagons with water-tight boxes into which it is put and carried off. If the boxes are not tight, the liquid part of the garbage would leak out into the street and besides being untidy would

attract flies. The garbage that is carried away is usually burned or fed to hogs.

Stables. — If one keeps a horse or cow and has a stable, unless he takes special precautions he will find that in warm weather there will be thousands of flies about. Flies lay their eggs in stable manure. The eggs hatch out. From each egg there comes a maggot called a *larva*. In a few days each maggot develops into a fly. If one were to want to raise flies, keeping a pile of stable manure would be the best way to do it. But we do not want flies about our houses.

LARVÆ OR MAGGOTS

From which flies develop. Flies lay eggs in stable manure. The eggs hatch into maggots. Each maggot develops into a fly.

If we could keep the stable manure in a box or bin with a cover that fitted so tightly that flies could not get in to lay their eggs, it would be all right. But this is difficult to do. It is hard to make a cover fit so closely that flies cannot get in. One can prevent flies from breeding by sprinkling over the manure borax or chloride of lime or kerosene. But the best way is to have the manure taken away once a week and carried to a field or farm where it can be used as fertilizer. If the stable is kept clean and the manure is taken away each week, flies will not breed in it. If this is not done there will probably be so many flies hatched out that they will become a nuisance to all the people living in the neighborhood.

The yard. — If one lives in a house with a yard one is fortunate. Many houses in the cities have no yards, or

perhaps all they have is a small yard behind the house. If one keeps one's house clean he will undoubtedly keep his yard clean and attractive, for in a sense the yard is a part of the home. If garbage is allowed to collect in the yard it will breed flies. If tin cans and other refuse are allowed to collect, they look unsightly. If trash collects, it may catch on fire and endanger the house. You can usually tell what kind of people live in a house by looking at the yard.

Outdoor toilet. — In cities and towns where there are sewers people have toilets in their bathrooms, and the body wastes are carried away through the sewer. Where there are no sewers people have outdoor toilets. These are usually placed in the yard a distance back of the house. These need to be built with care and kept as clean as any part of the house. One must remember that flies feed on filth wherever they can find it as well as on the food on our tables, if they can get into our houses; also that in feeding they will soil their feet and may soil our food with the dirt from their feet. The little dark spots which flies leave on windows and walls, and on our tables as well, are the body wastes of the flies which they eject from their intestines.

Not only should the house be screened to keep out flies, but the outdoor toilet should be screened just as carefully. It would be fortunate if there were no flies in the world, but as long as we have them we must do what we can to keep them from doing us harm.

Questions

1. What are the floors of houses made of? What are they covered with? What do you think of using rugs and carpets on the floors? Which do you think is better? Why?

2. What is garbage?

3. What should be done with garbage? Why?

4. What may be done with garbage if one lives in the country?

5. How is garbage taken care of in the cities?

6. What happens if the garbage is thrown out on the ground in the yard?

7. Why are there likely to be many flies in the neighborhood of a horse or cow stable?

8. Where do flies like to lay their eggs? When the fly eggs hatch what comes out of them? What do the maggots (or larvæ) turn into?

9. If one wanted to raise flies what would be the best way to do it?

10. How may flies be prevented from laying their eggs in stable manure?

11. What is the best way of taking care of stable manure so that flies will not hatch in it and become a nuisance and a danger?

12. What can you say about how a yard should be kept? Why?

13. Why should outdoor toilets be properly built and well cared for? Why should they be screened?

14. When you see a fly, do you stop to think where the maggot probably lived from which the fly came or upon what the fly may have been feeding an hour before?

PART IV

Community Hygiene and Sanitation: or What our City and State Governments Can Do to Protect Our Health

CHAPTER XXXI

How We Get Good Milk

Of all the things we eat to nourish our bodies, cows' milk is the most important. It is the best food for babies who are not nursed by their mothers. It should constitute a large part of the diet of growing boys and girls. It furnishes lime and substances which are not present in sufficient amount in other foods. It is valuable in smaller amounts as food for grown men and women. Babies eat little else than milk. Growing boys and girls need a quart of milk a day. Most grown men and women should drink a pint a day.

We learned in previous chapters that disease microbes may sometimes get into milk if it is not properly handled. Milk is our most valuable food, but to be good it must not contain living disease microbes. Fortunately disease microbes are quickly killed by heat. Much of the milk sold in cities is heated for this purpose and so is perfectly safe. The process of heating milk is called pasteurization. When you buy milk which is labelled "Pasteurized," you know it has been heated to kill any disease germs which might have accidentally got into it.

Milk is an animal product. It comes from cows. Other animal products, such as meats and fish, are cooked before they are eaten. Milk is usually not cooked. It is eaten, or rather drunk, raw. To be sure, milk is heated when it is pasteurized, but it is not heated so hot that you would

say it was cooked. For this reason we want milk from healthy cows, and we want it handled in a cleanly way and kept free from dirt.

Some people have their own cows. — People who live on farms and many who live in small towns keep their own cows to supply them with milk. They can have just as clean, good milk as they want. They know whether

A Clean Barn and Barnyard
The cows are also clean.
(From Bulletin 56, Hygienic Laboratory.)

their cows are healthy and can be sure that the milk pail is clean and that in milking dirt from the cow or from the stable does not get into the milk. As they are the only ones who handle the milk, they know that the disease microbes from others cannot get into it.

Where people in cities get their milk. — But with people in cities it is different. They cannot keep their own cows. The milk they use must be brought in from farms out in the country. The milk for a city may come

from a thousand farms or for a large city from ten thousand farms. Some of these farms may be located many miles from the city, and the milk may be shipped in on trains. When it reaches the city it is usually put into bottles and delivered to the houses by the "milkman."

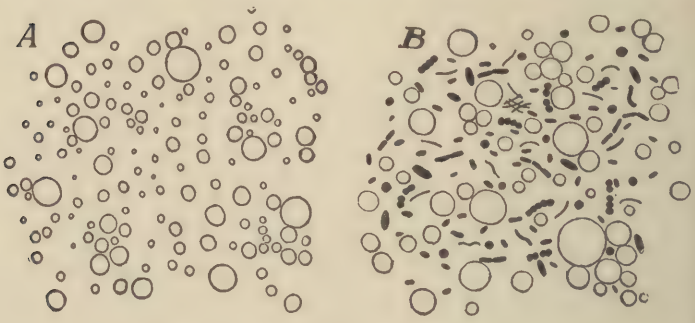
If the milk for a city comes from a thousand farms, it has been handled by people in a thousand families on these farms. There are usually about five people in a family, so that in the thousand families there would be five thousand people. The milk would be exposed on the farms to the diseases of five thousand people. Some of them might have diphtheria or scarlet fever, or perhaps typhoid fever, or be just recovering from one of these diseases, and some of their microbes might get into the milk and be carried to the people in the city. This is why most milk used in cities is pasteurized to kill any disease microbes there may be in it.

Good microbes in milk. — If milk is not kept in the ice box it soon turns sour. Certain microbes in it cause it to sour. These microbes are always present in milk, and when the milk is allowed to get warm the microbes multiply until there are many millions of them in a teaspoonful. As they grow and multiply they change the sugar in the milk into an acid called lactic acid. This is what gives milk a sour taste. It is this acid also that causes the milk to curdle. We said the microbes change the sugar to acid. All milk has some sugar in it. The sugar in milk, however, is not sweet like the sugar you buy at the store. The sweet sugar you buy at the store is called "cane sugar." The sugar in milk is called "lactose."

The microbes which turn milk sour are not harmful. In

fact they may be thought of as good microbes. Buttermilk, which many people drink and like, is usually sour and contains millions of these microbes.

How disease microbes may get into milk. — But unfortunately there are also certain disease microbes which can live and multiply in milk. These are the microbes of typhoid fever, diphtheria, scarlet fever, and of a severe kind of sore throat called septic sore throat. If people with any of these diseases milk the cows or handle the



MILK SEEN THROUGH A MICROSCOPE

A, Clean milk, showing no germs. *B*, Dirty milk, containing many germs.

milk at any time, their microbes may get into the milk. If their hands are dirty, the microbes may get into the milk when they milk the cows. Or they may sneeze or cough over a pail of milk and microbes from their mouths may fall into the milk. If the milk is cooled as soon as it comes from the cow and is kept cold, these microbes will not multiply, although they will remain alive. But if the milk is allowed to get warm the microbes will multiply, and although only a few may have got into the milk, they may become millions in a short time.

There is another disease the microbes of which get into milk. Cows have tuberculosis just as people do. Milk from cows with the disease contains the microbes of tuberculosis. Milk that is to be used by people should come only from healthy cows. Fortunately there is a way that the farmer can tell whether any of his cows have tuberculosis. It is called "the tuberculin test." A small amount of the poison of the tuberculosis microbe is injected beneath the skin of the cow, and if the cow develops a fever within a few hours, it shows that the animal has the disease. If the cow is healthy, no fever will develop. If the cow has tuberculosis, its milk should not be used by people. Usually the cow is killed. All good farmers who sell milk for people to drink test their cows in this way. In many cities milk is not allowed to be sold unless it comes from cows which have been tested and are known to be free from tuberculosis. This helps to keep our milk safe. Then, too, the microbes of tuberculosis and of the other diseases are killed by the method of heating called pasteurization of which we have told previously. Pasteurization is the one sure way we have of killing any of the disease microbes which may have got into the milk. Dead microbes do us no harm. Properly pasteurized milk is safe milk and the best and cheapest of foods.

Questions

1. What is the most important food? Why?
2. What is milk? Where does it come from?
3. Where do the people in cities get their milk?
4. What makes milk turn sour? Are the microbes which turn milk sour harmful?
5. What disease microbes may get into milk?

6. How do disease microbes get into milk?
7. What disease do cows have of which microbes may get into milk?
8. How can it be told whether a cow has tuberculosis?
9. How may the microbes in milk be kept from multiplying?
10. How may the disease microbes in milk be killed?

CHAPTER XXXII

How We Get Good Milk (Continued)

How milk should be produced; healthy cows. — Milk intended for people to drink should come only from healthy cows. The cows should be healthy in every way. They should not have tuberculosis or any other disease. All cows in the herd should be tested for tuberculosis once or twice a year. The cows must also be properly taken care of. Like people, if cows are to remain healthy, they must be kept clean, have a good place to sleep, have good air to breathe, good water to drink, and be given proper food to nourish their bodies. Out in the West where the herds of cattle live on the plains and are in the open air all the time, the cattle are usually healthy; they are seldom sick and almost never have tuberculosis. But when cows are kept shut up in barns and sheds and get little exercise, they have to be specially well cared for or they will get disease. In this way they are like people.

The barn or stable in which cows are kept should have plenty of windows so that the animal will get clean, fresh, cool air to breathe. The cow should be kept clean, and the stables too. Not only will cleanliness help keep the cows healthy, but it will make it possible to get clean milk. It is impossible to get clean milk from a dirty cow in a dirty stable. Sometimes where people do not know how to produce good milk, they let their cow-stables get very dirty. But one does not see dirty stables so often

now as one did many years ago before people knew what was necessary to produce good milk. Many city health departments send men out to inspect the cows and the stables on farms producing milk for sale in the city. These

A Modern Dairy

The barn is clean; the cows are clean; and the men have on clean white suits and caps. A place like this produces the cleanest milk.

men see that the cows are healthy and that the stables are kept clean.

Milking. — Milk when taken from the cow is milked into a pail. The cow should be first cleaned, for if the cow is dirty, dirt will fall into the pail. The milkers' hands should be clean, for if they are dirty some of the dirt will be washed into the milk. Many people use a pail with a small top, because the smaller the top of the

pail the less chance there is for dirt to fall in. At many of the best dairies the cows' udders are washed clean before being milked, and the men who do the milking first wash their hands and put on clean white suits. Milk produced in this way is almost sure to be clean.

Handling milk on the farm. — After the milk is taken from the cow it is usually strained through cheesecloth or a fine strainer to remove any particles of dirt which may have accidentally fallen into it. It should then be cooled if possible and kept cold, for when kept cold milk keeps better and does not sour, and the microbes in it do not multiply. Before being used the milk pails and the cans in which the milk is kept should have been washed clean with soap and water and then scalded with boiling water to sterilize them, that is, to kill any microbes which might have been in them. If this is not done, the pails and cans will be dirty and will contain many microbes, and the milk will not keep well.

Getting milk to the city. — For large cities the milk has to come from many farms, and some of them will be many miles away. The milk from these farms may be hauled to the city in wagons if the farms are not too distant. Often nowadays motor trucks collect the milk from a number of farms and carry it rapidly to the city. Frequently the milk is shipped to the city on trains. The important thing is to get it to the city just as quickly as can be done and to keep it cold while it is on the way.

What becomes of the milk when it reaches the city. — When the milk reaches the city it usually goes to a large city dairy. Here it is run through a machine which takes out all the dirt. Then it is pasteurized to kill any disease germs that may have got into it from the cows, or from

the people who did the milking, or from those who handled it on the farms, or while it was being taken to the city. Then it is put into bottles which have been washed and sterilized in boiling water. The paper caps are put into the tops of the bottles and the milk is cooled. In many well-equipped dairies, the bottles are filled and the paper

A Sanitary Bottling Room

Here milk is kept pure by absolutely clean handling. Notice the clean, white clothing of the men.

caps are inserted in the tops by machine so that no one's hands come near the milk after it is pasteurized. Later the milk is delivered in the bottles to the homes of the people who are to use it. The milk is usually delivered by wagons in the early morning so the people will have fresh milk for their breakfast.

Medical inspection of persons handling milk. — Many

city health departments in order to protect us still further from the possibility of getting disease microbes in milk, examine the people who handle the milk in the dairies, to make sure they have no disease of which the microbes might be spread by the milk.

Care of milk in the home. — If the milkman delivers to our houses good clean milk free from disease microbes, we must not let it get contaminated in our houses. Milk keeps best if it is not allowed to get warm. If it gets warm the microbes in it grow and multiply and turn the milk sour. Milk should be kept where it is cold. In warm weather it should be kept in an ice-box. When it is removed from the bottles it should be poured only into clean dishes. Flies should not be allowed to get near it, or, worst of all, into it. The milk should not be handled by a person who is sick with a microbe disease, and no one should cough or sneeze over milk in a pitcher or dish, for if he does he will spray into it sputum and microbes from the mouth.

Care of empty bottles. — When milk is delivered to people in bottles, the empty bottles have to be returned to the milkman so that they can be used again. When emptied the bottles should be washed clean and kept clean until returned to the milkman. Food should not be put into them, nor should they be used for any other purpose. We must help the milkman keep the bottles clean. He will wash and scald them before he puts milk into them again, but if they are very dirty it may be difficult for him to get them as clean as they should be. We want our milk brought to us in clean bottles and so do other people.

Milk sold in small towns. — In towns and small cities often the milk is brought to the houses by the farmers

who produce it on their farms. They bring the milk in from the farm each morning and deliver it to the houses. Usually it is not bottled, but is dipped from a large can, and each family takes to the wagon the pail or pitcher into which the milk is poured. This milk is not pasteurized. Sometimes the town or county health officer inspects the farms to see that the cows are healthy and the stables kept clean, but very often he has not had time to do this. If the milkman has healthy cows and keeps his stables clean and is careful about handling the milk, the milk is pure and clean. If this is not so, the milk may be dirty and not the kind one should drink. People who buy milk from a farmer should visit his farm and see how he keeps his cows and whether he knows how to keep the milk clean.

Milk can be made safe by boiling just as water is. Boiling kills any disease microbes there may be in it. But most people do not like boiled milk. The boiling changes the taste.

Milk our most important food. — In the cities the health departments control the sale of milk, and, in so far as they can, see that only good milk is sold. Bottled pasteurized milk is usually the safest and best. In small towns each family often has to be its own health department and see that the milk it gets is clean and comes from healthy cows. It is as necessary that the dairyman be clean and use clean pails and cans for his milk as it is that the person who cooks and prepares our food is clean and uses clean dishes.

Milk is our most important food, and when we consider the nourishment and necessary substances it furnishes the body, it is our cheapest food.

Questions

1. Why should milk from healthy cows only be sold?
2. Why should cows be kept clean? Why should cow stables be kept clean?
3. Why should a cow not be milked by a person with dirty hands?
4. Why should milk always be kept cold?
5. Does your milkman leave your milk in bottles?
6. What can you say about how milk should be taken care of after it has been delivered by the milkman? Why should it be kept cold and clean?
7. Why should empty milk bottles be washed and kept clean?
8. Why is properly pasteurized milk the safest kind to drink?

CHAPTER XXXIII

Water — What It Is; the Need for Good Water and How to Get It

We must have water to drink, but we need it also for many other purposes. We use water to bathe in and in washing our hands and faces. Our clothes are washed in water. Water is used in cooking and for washing the dishes from which we eat. Floors and windows are washed with water. When we have bathrooms in our houses, we must have water piped in so that it will flush the toilets. Then, too, factories and manufacturing establishments often use large quantities of water.

People live only where there is water. — People do not live where they cannot get water. Cities can grow only where there is sufficient water available to furnish the people with what they need. In desert regions where water is scarce the people will always be found living near the springs or other sources of water. The presence or absence of water determines where people can live. Water is as necessary as food, but if it becomes polluted it may be harmful. If sewage gets into it, it may spread disease such as typhoid fever.

Where water comes from. — All water may be thought of as coming from rain or snow. Water vapor rises from the surface of the sea and lakes and rivers, forms clouds, and later falls as rain. The water falling as rain either sinks into the ground or flows along the surface into a stream and finds it way finally back to the sea.

Water is made up of two elements combined together. These are the gases *oxygen* and *hydrogen*. If an electric spark is passed through a mixture of two parts hydrogen gas and one part oxygen gas, water is formed. Pure water is clear and has no odor or taste. It is very difficult, however, to get absolutely pure water, for water takes up many substances with which it comes in contact. It dissolves not only such substances as sugar and salt, but takes up gases as well. Even rain as it falls absorbs gases from the air.

When rain falls to the earth and then runs over the surface and into a stream or river, it carries with it a certain amount of earth, decaying vegetable matter and other dirt. Most of this soon settles, however, as the stream flows along, and the water becomes clear again. If the water sinks into the ground, it may pass over or through mineral substances, such as limestone or iron or sulphur deposits, which it will dissolve. Limestone makes water hard, that is, soap curdles in it. Iron and sulphur give it an unpleasant taste, as all know who have drunk the water from iron or sulphur springs.

Some water is unsafe to drink. — Water is not safe to drink when it has become polluted with sewage. Sewage may get into river or lake water when cities or towns or even farm houses empty their sewage into the stream or lake. Sewage may get into a well when the surface of the ground is polluted and the rain washes the pollution into the well or when an outdoor privy is placed too near the well. The chief danger in drinking water polluted with sewage even in a small amount is that we may contract typhoid fever, for typhoid fever is carried by sewage. Microbes of typhoid fever pass into the sewage from the

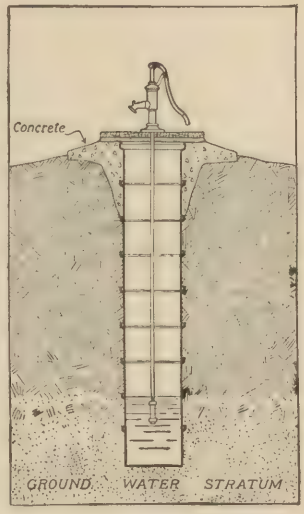
bodies of persons sick with the disease. If the sewage gets into wells or into springs or rivers, people who drink the water are likely to get typhoid fever. There has been a great deal of typhoid fever in the United States in the past, especially in the cities and towns. Much of it has been due to the fact that the water used by the people for drinking was polluted by sewage.

Rainwater. — Rainwater is sometimes used for drinking. The rain as it falls is good water and perfectly safe to drink. If it is collected from the clean roofs of houses and stored in properly built cisterns, well covered so that neither dirt nor animals can get in, the water will be free from harmful substances. Such cisterns should always be so covered that mosquitoes cannot get in, for if they do they will lay their eggs on the water. These will later hatch and finally develop into full grown mosquitoes. In this way we may breed in our own yards enough mosquitoes to make ourselves and our neighbors miserable.

Wells. — People living on farms and in small towns usually get the water they need from wells. A well is a hole made in the earth extending down until it reaches water. This water in the earth is the rain which has sunk into the soil instead of running off into streams. The water usually sinks down through the earth until it comes to a hard layer of rock or clay. It can then go no farther, but stays in the earth above this layer, or *stratum* as it is called. If a hole is made down to this, the water will run into the hole and can be pumped up.

If a well is not over thirty feet deep it is called a surface well. Surface wells are usually dug with spades and shovels, and are holes from four to six feet in diameter. If the water is to be used for drinking, the sides of the well

should be lined with brick, stone, or terracotta tile. The joints between the brick or stone or tile should be filled with cement mortar. This lining wall of the well is called the casing. It should extend up above the surface of the ground for at least a foot, so that rain cannot run into the top of the well and carry in dirt from the surface of the ground. The top of the well should be tightly covered so that neither drippings from the pump nor rain can get in. A tight cover also keeps out animals. If a well is not so covered, cats and dogs and sometimes rats will fall in and drown. Their bodies are often not found, and remain in the well. It is not pleasant to think of drinking water from such wells.



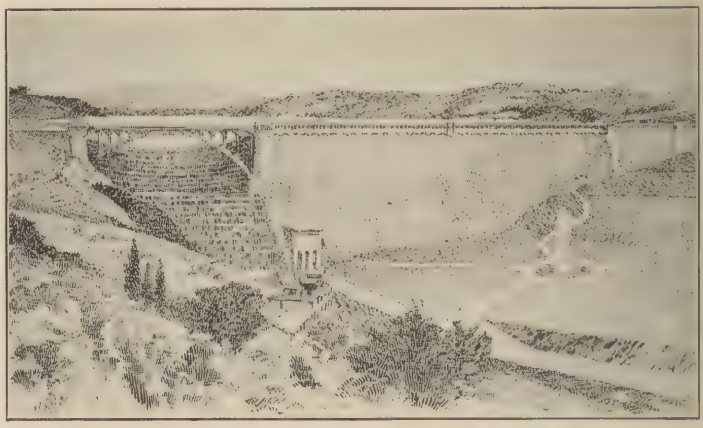
A Properly Built Well

The top is above the surface of the ground, and is tightly covered. The casing of the well is made of terracotta tile with tight joints.

When a well is dug it should be placed as far as possible from stables and outdoor privies, especially from any privy which is merely a hole in the ground like the well, for the contents of the privy may soak through the ground and get into the well. Water from a well polluted in this way is dangerous and not fit to drink.

Some wells are made by drilling small holes very deep in the earth, sometimes several hundred feet or even deeper. These holes usually pass through one or more hard layers or strata through which the water from the

earth cannot pass. The holes are lined with iron pipes and the water is pumped up. Such a well is called a drilled well, and the water is usually very good and safe. It should be carefully covered at the top, however, just as is done with shallow wells, so that neither water nor animals can get in. Sometimes in a deep well of this kind the water



CROTON DAM

This is one of the dams that hold back water for the supply of New York City.

will come to the surface and flow out of the top. When it does this it is known as an artesian well.

Sometimes wells are made by driving iron pipes into the earth until water is reached. Pumps are then put into the pipes to bring the water to the surface. These are called driven wells and are much like the drilled wells. They should be carefully covered at the top.

Public water supplies. — In most cities water is furnished to the houses from a public water supply, so that wells are not needed. The water is usually pumped through

pipes, and there is a small pipe leading to each house. If you want water all you have to do is to turn on the faucet.

The water furnished in this way by cities should be good water and not polluted by sewage or the people will get typhoid fever. Some small cities get all the water they need by digging or drilling a number of big wells, but most cities have to get their water from lakes or rivers. Sometimes a city can get safe water by extending water pipes up to the mountains where nobody lives and where a stream can be found in which the water is pure and free from sewage. This water can be brought to the city in large pipes.

However, most cities have to get their water from rivers or lakes into which other towns and cities often empty their sewage. Sometimes a city empties its own sewage into the lake or river from which it gets its water. Such water is polluted and is unsafe to drink. It must be purified in some way. Usually it must first be allowed to stand in a large reservoir so that most of the mud and dirt will settle to the bottom, then the water is passed through some kind of a filter. Filters in which the water passes through sand are the ones most frequently used. The sand takes out not only the dirt, but most of the germs which get into the water with the sewage. Some cities have to put chloride of lime into the water to make it safe to drink. The chloride of lime kills any typhoid microbes which may be in the water.

A city sometimes has to spend a great deal of money to get enough pure water for the people, but it is far better to spend the money for good water than it is to have many cases of typhoid fever. Then, too, plenty of good water means it will be easier for people to be clean. With plenty of water they can have a bath as often as they

want, and there will be plenty of water for washing clothes and other things about their homes.

If water is polluted and unsafe to drink, we can always make it perfectly safe by boiling it. The boiling will kill any disease microbes there may be in it.

Questions

1. What is water used for?
2. Why do people always live where they can get water?
3. Where does water come from? Where does the water in snow and rain come from?
4. What is pure water like?
5. Why is it difficult to get pure water?
6. What makes water hard? What is meant by hard water?
7. When is water unsafe to drink?
8. What disease is most often spread by drinking water polluted with sewage?
9. When is rainwater safe to drink?
10. Why should cisterns in which rainwater is stored be kept covered?
11. What is a surface well?
12. How should a surface well be made? Why?
13. Why should a well wall, or casing, extend up above the surface of the ground and be tightly covered at the top?
14. What is a drilled well? What is a driven well?
15. How can the water in wells become polluted and unsafe to drink?
16. Where do cities usually get the water furnished to the people?
17. What precautions must be taken by a city to get pure water? Why?
18. Where does your city get its water? Is it pure water and safe to drink? Does your city have to filter its water or put chloride of lime into it?
19. Why do cities sometimes have to spend much money to get pure, safe water?
20. How can water always be made safe to drink? Why does boiling make water safe?

CHAPTER XXXIV

Sewage, What It Is and How Disposed Of

People who live in cities usually have toilets in their houses to carry off the waste products of the body. They also have bathtubs which empty when the stopper is pulled out, and sinks in the kitchen into which dishwater is poured. Where does all this dirty water and waste matter go, and what becomes of it? It flows through pipes into a sewer, and it is called *sewage*. The sewer carries it away. Do you know where the sewers of your city empty?

Why sewage may be dangerous to health. — Sewage contains the waste products from houses and of the people who live in them. It contains not only the dirty water from washing dishes, floors, and clothes, but also sputum, excrement, and other body wastes. Where many people live, as in a city, there will be some who are sick with such diseases as typhoid fever, and the waste products from their bodies will be filled with the microbes of this disease. The sewage will contain these microbes, and if the sewage should get into the water which is used for drinking purposes and the microbes should still be alive, those drinking the water would get typhoid fever.

How sewage is carried away in cities. — In cities the dirty water from houses and the waste products from people's bodies are carried away in sewers. In each house the pipes from the sinks, bathtubs, and toilets all empty

into one large pipe which extends under the ground from the house to the street, where it empties into a still larger pipe. The pipe in the street is called a street sewer, and it receives the sewage from all the houses along the street. The street sewers empty into still larger sewers, which finally carry the sewage to some river or lake into which it flows.

In cities the rain that falls and the water from melting snow have to be carried off or they would form puddles and ponds. This water is also carried away by sewers. Sometimes it is carried off by the same sewers that carry the sewage from houses. Sometimes separate sewers are built to carry off the rainwater. You have noticed how during a rain the water will run along the streets, and usually when it reaches a corner flows into a hole. This hole is sometimes at the edge of the pavement and sometimes opens under a sidewalk. The water which enters this hole runs down into the sewer, where it is carried away. While the rainwater which enters the sewer is dirty water from the streets, the sewage from houses carries in it body excrement and disease microbes.

Where sewers empty. — Sewers from cities usually empty, as has been said, into a river or lake. Cities also often get their drinking water from rivers and lakes, sometimes from the same river or lake into which they empty their sewage. For this reason there have been a great many cases of typhoid fever in some cities. The microbes of typhoid fever in the excrement of the sick have been carried by the sewers to the river or lake where they would get into the water supplied to the people of the city for drinking. Many of the people who drank the water would then develop typhoid fever, so that the sewers

carried the microbes away, and the drinking water brought them back. Because of this many people were sick all the time. Fortunately typhoid microbes do not live very long in water, but many die in a few days and most of them within a month.

Sometimes one city empties its sewage into a river and it flows down the river to where another city gets its drinking water. Then the people of the second city will have typhoid fever unless they purify the water by filtering or in some other way.

How some cities purify their sewage. — To keep from polluting the rivers and lakes into which they empty their sewage with body excrement and disease microbes, many cities purify their sewage to remove most of the substances and microbes from it. This is done sometimes by letting the sewage flow into reservoirs where the solid parts settle to the bottom and only the fluid part flows on. Sometimes it is run through a screen which takes out all the larger solid parts. Sometimes the sewage is allowed to remain for a time in tanks where the good microbes decompose the solid matter in the sewage and kill most of the disease microbes. Sometimes it is passed through coarse filters of broken stone and sand. Sometimes one, sometimes several, of these methods are used by a city to make its sewage less unpleasant and less dangerous before it empties into the river or lake from which it and perhaps other cities take their drinking water.

Sewage in small towns. — Small towns often have no sewerage systems to carry off the dirty water and body wastes from the houses. In places where they have no sewers, the people usually let the water from kitchen sinks and bathtubs run out on to the ground or into a

ditch near the house, and instead of having toilets in the houses, they have outdoor toilets in the yards to receive the excrement and the body wastes.

Outdoor toilets. — People often do not understand that outdoor toilets may be the cause of spreading disease to themselves and to others unless they are properly built and taken care of. As a result outdoor toilets frequently are poorly built and neglected. If the body wastes from a person with typhoid fever get into the outdoor toilet, or privy, as it is often called, the microbes of the disease may pass through the ground with water and get into a well if there is one near. Then people who drink the water from the well may get the disease. Or flies may get at the excrement and get the microbes on their feet and legs and carry them to the tables and food of all the people living in the neighborhood.

There is no part of the house that should be given more attention than the outdoor toilet. There is none that is more important to the health and welfare of the family and of the people living in the neighborhood. If there are wells anywhere near, the toilet should be so built that the body wastes, and the microbes in them, cannot soak into the ground, and it should be so screened that flies cannot get in. Every opening should be covered with screening. The door should fit tightly, and there should be no crack big enough to let a fly get through.

Often buckets or cans are placed under the toilet seats to receive the excrement, which is kept covered with ashes, or lime, or even dry powdered earth. The cans are then taken away every few days and the contents buried where they will not do harm. This is a very good and convenient way of taking care of an outdoor toilet.

It is well known to physicians that people who go away in the summer to summer resorts often return home with typhoid fever. This is usually because they have been to a place where the people had outdoor toilets which were not properly built and were taken care of poorly or perhaps not taken care of at all. Somebody with typhoid fever, or it may be someone who had recently had the disease, was at the resort, and the flies carried the microbes from the toilet used by him to the food of many people who were spending their vacation there. This is one reason why many people get the disease at summer resorts.

Many people take pride in keeping their houses clean and in order. Where outdoor toilets are used they should be given as much attention as the kitchen or any other part of the house.

Questions

1. What is sewage? What are sewers?
2. Why may sewage be dangerous to health?
3. Where do the sewers of cities usually empty?
4. Where do the sewers of your city empty?
5. Why do some cities have many cases of typhoid fever?
6. How do some cities partly purify their sewage?
7. In places where they have no sewers, how do the people get rid of waste water from the houses? How do they dispose of the body wastes?
8. Why may an outdoor toilet be dangerous?
9. What can you say about how an outdoor toilet should be built? Why should it be screened? Why should it not be near a well?
10. Why do people who go to summer resorts often return home with typhoid fever?

CHAPTER XXXV

The City Health Department and What It Does

Cities have fire departments to protect the people from fires. If a house gets on fire, the fire department immediately sends its trucks and men who put out the fire and prevent it from spreading to other houses. If it were not for the fire department, the house would probably burn down and the fire would often spread to other houses and the loss would be great. If there are people in the burning building, the firemen get them out. In this way the fire department protects us and our houses from fire.

Cities have police departments to protect the people from burglars and other evildoers. The police enforce the laws made for the protection of the people. They protect us from those who would steal the things which belong to us and from those who would do us injury.

Cities have health departments to protect the people from disease. People can do a great deal to protect themselves from disease, but there are many things that they cannot do, and there are many things the health department can do for them better and more easily than they could do them for themselves.

We have learned how disease microbes may get into water and milk and disease be spread, how flies and mosquitoes may spread disease, and how people who are sick may spread disease to others. The health department looks after the water and sees that it is safe, looks after

the milk and sees that it is not contaminated, keeps flies and dangerous mosquitoes from breeding, and sees that sick people do not go about spreading disease to others. The health department tries to make it possible, in so far as it can, for people to be strong and healthy and keep free from disease. City health departments are very busy doing many things for us.

What a city health department consists of. — In some cities there is what is called a board of health. Where there is a board of health, it has supervision over the work of the health department. A board of health usually consists of from three to nine members. The members of the board are in most cases physicians. Many of the boards also have engineers and lawyers on them. These boards do not themselves carry on the work of the health department but decide what work shall be done and sometimes how it is to be done. Usually the members of the board are appointed by the mayor of the city. In only a very few cities do the members of the board receive any pay for their work. It is considered an honor to be appointed a member of the board of health and help protect the lives and health of the people. The members of the board do not have to give all of their time to the work. The board meets from time to time and the members talk over the work of the health department and decide what needs to be done.

The health officer. — All cities have a health officer who is in charge of the work of the health department and sees that the things the board of health wants done are carried out. The health officer is usually a physician. Except in the smallest cities, he spends all his time attending to the work of the health department and is paid for his work.

Except in the smallest cities, he has many men and women working under him doing the things that have to be attended to.

Control of communicable diseases. — You learned in a previous chapter how some diseases are caused by microbes and how these diseases are spread from one person to another by microbes from the sick. To keep these diseases from spreading precautions have to be taken to prevent the microbes in the mouths and bodies of sick people from getting to well people or into their food or into the water or milk they drink. This is one of the things the health department has to do for us. In order to protect us they have to know which people have these diseases.

How the health department finds out where there are cases of disease. — When a person is sick he usually has a physician come and see him. The physician comes and finds out what kind of sickness he has and what he needs in order to get well. The physician knows whether he has a disease that can be spread to others by microbes. For this reason the law requires that physicians report to the health department whenever they have a case of a dangerous microbe disease such as scarlet fever, measles, smallpox, diphtheria, or typhoid fever.

What is done to prevent disease spreading from the sick to the well. — As soon as a case of one of these diseases is reported, the health department sends out a physician or nurse who knows what needs to be done to prevent the disease from spreading to other people. Sometimes a sign is tacked up on the house so that people will know that there is a case of scarlet fever or diphtheria or smallpox in the house; whatever the disease is. Then people will not go in, for they will know that there is a

case of a communicable disease in the house. The sick person's doctor and the health department physician or nurse work together. The sick person's doctor takes care of him and sees that he gets well. The health department physician or nurse sees that precautions are taken so that the disease will not spread to others. The doctor cares for the sick. The health department protects the well.

If the sickness is a case of diphtheria and there are children in the house, the health department will probably give all the children *antitoxin*. This will keep them from getting the disease. Antitoxin is a substance which destroys the poison of the diphtheria microbe. It is injected beneath the skin and is carried by the blood from the place where it is injected to all parts of the body. It will stay in the body for several weeks, and during that time will protect a person from getting diphtheria.

What is done to prevent disease spreading among school children. — If there are children in the house who go to school, the health department either has them stay out of school so that they will not carry the disease to other children in the school, or perhaps has them go and live in some other place. Then after they have stayed away long enough to be sure they have not caught the disease, they can go back to school without harming others.

Sometimes the sick person is a child who has been going to school, and he may have been a little sick the last day or two he was at school. If this is so, he may have already spread his microbes to other children. Then the health department sends some one to the school to tell the teacher about it, and the children are watched from day to day, and if any of them appear to be getting sick, they are sent home until it is found out whether

they have the disease. In most microbe diseases a person does not get sick until several days after he has got the microbes into his body. The microbes have to multiply in one's body for several days until there are millions of them before one feels sick. In scarlet fever and diphtheria it takes only a few days, sometimes only two days. In most diseases it takes longer. In measles and smallpox it usually takes about two weeks.

What may be done if the disease is diphtheria. — If the disease is diphtheria, the health department or the school physician may examine all the throats of the children in the room and find out whether any of them have diphtheria microbes in their mouths. Some children may have the microbes in their throats and not get sick, for some people do not get diphtheria. They are said to be *immune*, which means that their bodies have in them the substances which destroy the poisons of the diphtheria microbe, so that it does them no harm and does not make them sick. However, people who are immune to diphtheria may carry the microbes in their throats and mouths and give them to others who will become sick.

We now have a way of telling when a person is immune to diphtheria and need not fear the disease. It is called the Schick test. A very small amount of the poison of the diphtheria microbe is injected into the skin, usually into the skin of the arm. If the person tested is not immune and can get diphtheria, the skin in a day or two gets red around the place where the poison was injected. Then the redness disappears in a few days. If the person is immune, and will not get diphtheria, nothing happens. The skin does not get red. This is because there were substances in the body which destroyed the poison as

soon as it was injected. Most men and women are immune to diphtheria, but only about half the school children are immune.

If some of the children in a schoolroom get diphtheria, the health department or the school physician may want to give all the children in the room the Schick test so that they may know who can catch the disease and who cannot. Or if there are many cases, they may want to give the test to all the pupils in the school. In some cities most of the school children have been tested in this way.

We said that some people are immune to diphtheria and need not fear the disease. All people can be made immune if they want to be. People are made immune by injecting beneath the skin a very small amount of the poison of the diphtheria microbe together with some of the substance which destroys the poison. Three injections are given a week apart. Then after a few weeks the person becomes immune, and will not get the disease even if the microbes get into his throat. In some cities the health department has made thousands of children immune to diphtheria in this way. These children do not need to fear diphtheria any more.

Questions

1. What is the purpose of a city health department?
2. What does a city health department usually consist of?
3. What is a board of health? What does it do?
4. What does the health officer do?
5. What do you understand by a communicable disease? Name some communicable diseases.
6. In order to prevent the spread of communicable diseases, what does the health department need to know about the existing cases?

7. How does the health department learn where there are cases of communicable diseases?

8. What can you say about the responsibility of physicians in reporting to the health department cases of communicable diseases?

9. How does a physician endanger the lives of people when he fails to report a case of communicable disease to the health department?

10. What should the health department do when a case of communicable disease has been reported to it?

11. Why does the health department tack signs on the houses where there are cases of certain communicable diseases?

12. For what diseases does the health department put signs on houses in your city or town? What color are these signs or placards? Do you think that putting up these signs is a good thing? Why?

13. What is the duty of a physician in taking care of a case of communicable disease? What is the duty of the health department?

14. What may the health department do if there is a case of diphtheria in a house?

15. If the person who has the disease is a boy or girl who goes to school, what may the health department do?

16. If there are other children living in the house who go to school, what may the health department do to prevent the spread of the disease to other school children? Do you think this is a good thing to do? Why?

17. If you were sick with a communicable disease, would you want to give it to others? Would you do all you could to keep from giving it to others?

18. Does one get sick as soon as he gets disease microbes into his body? How long is it before one gets sick? Why? How long does it take in scarlet fever? How long in measles?

19. May people have diphtheria microbes in their throats and not get sick? Why?

20. What is meant when it is said that a person is immune to a disease?

21. How can it be told whether a person is immune to diphtheria?

22. Can people be made immune to diphtheria? How?

23. How are people made immune to smallpox?

CHAPTER XXXVI

The City Health Department and What It Does (Continued)

What will be done to prevent the spread of disease by milk. — If the disease which has been reported to the health department is one which can be spread by milk, the health department will probably see that the milkman does not take empty milk bottles away from the house. He may leave milk, but will not be allowed to take empty bottles away. This is because some people are careless in the use of milk bottles. They use them for all sorts of things. The bottles may have microbes of the disease in them. If they are taken away and if the milkman should fill them again with milk without first sterilizing them in boiling water, the next people who got the bottles filled with milk might get the disease. If the milkman scalded the bottles in boiling water before putting fresh milk in them, there would be no danger. All good milkmen do this. There are some, however, who do not.

If there is anyone living in the house with the sick person who works in a dairy or in a place where milk is sold, the health department will usually make sure that he has not got the disease, too, and will probably either have him stay home from work or else go somewhere else to live. If he continued to live at the house and each day handled milk which was to be used by others, he might

carry the microbes to the place where he worked and get them into the milk. Then others might get the disease.

What the health department may do to protect others living in the same house with the sick. — The work of the health department is to prevent the disease from spreading to other people. This includes other people living in the same house with the sick person as well as people who do not live in the house. Very often the best way to protect the other people living in the house is to take the sick person to a hospital. When this is done there is no longer any danger of the microbes getting into the bodies of the other members of the family and giving them the disease. This is often necessary to protect the other children, brothers and sisters. Then, too, it is often best for the sick person, for at the hospital there will be nurses to watch over and care for him and physicians to see that he gets whatever he needs. Then when he is well again he can return home without there being any danger that he will give the disease to others.

Sometimes the sick person can be taken care of at home, and then the doctor taking care of the case or the health department physician will have the sick one kept in a room with plenty of windows so that there will be enough air and the patient will be comfortable. The nurse or person taking care of the sick will be shown how to keep everything clean and how to prevent the microbes from getting to other parts of the house and to other members of the family. She will be told about washing her hands after handling the sick and what to do with the patient's handkerchiefs and bedding and what to do with the dishes from which the sick one eats. It is unpleasant to be sick, but when one is sick it is good to know

that one is being so taken care of that the disease will not be given to brothers and sisters.

What the health department may do for persons having tuberculosis. — In most cities physicians report to the health department whenever they have a patient with tuberculosis. People with this disease are usually not so sick that they have to stay in bed. If they are in bed, the health department can send to them a nurse to see that they have everything they need. The nurse will tell them how to take care of their sputum and what to do so that they will not give their disease to others, if they have not already been told these things by their physicians.

If they have not everything they need in order to get well, the health department will probably offer to send them to a hospital or a sanatorium where they can be well taken care of and where there will be physicians and nurses to see that they are given every attention and that everything possible is done for them so that they may get well. Then, too, if they go to a hospital or sanatorium there is no danger that the disease will be given to other members of their families, especially to children. Children catch the disease much more easily than do grown men and women.

Most city health departments also have what are called dispensaries, where people with tuberculosis who have no physician of their own can go and be treated free by health department physicians, and can be told what to do to get well, and what to do to prevent spreading the disease to others.

Questions

1. How can disease be carried by milk bottles?

2. What does the health department do to prevent communicable diseases from being spread from house to house by milk bottles?

3. What can be done when there is a case of a communicable disease in a house, to prevent the other people in the house getting it?

4. When should the sick person be taken to a hospital? Why is it sometimes better for the sick person when he is taken to a hospital? Why is it sometimes better for the other members of the family?

5. What kind of a room should the sick person be put in? Why?

6. When one is taking care of a person sick with a communicable disease, what precautions should be taken? Why?

7. What precaution should be taken by one who has tuberculosis to keep from giving the disease to others? Why?

8. Why is it often better for a person with tuberculosis to go to a sanatorium?

CHAPTER XXXVII

The City Health Department and What It Does (Continued)

What the health department may do for babies. — Most cities have what are called "infant welfare stations," where mothers who have no physicians of their own can take their babies if they are sick and have physicians tell them what they need. Sometimes the baby needs medicine. Sometimes the baby is not getting the right kind of food. If this is so, the mother will be told just what to feed it. The mother can take the baby every few days and have it examined and weighed to see how it is getting along. If it needs specially prepared milk, the mother can usually get it at the welfare station or the physician there will tell her where to get it.

What the health department does for the physicians of the city. — Most city health departments have laboratories to which physicians can send samples of blood or sputum to be examined. If a person has a sore throat, the physician cannot always tell whether or not it is diphtheria or just a simple sore throat. The health department will furnish the physician with little swabs of cotton attached to slender sticks and sealed in a glass tube. The physician will take one of the swabs and rub it over the sick person's throat so that it will get on it some of the microbes from the throat. This is then rubbed over some jelly-like material in another glass tube and

sent to the health department, where the microbes are examined to find out whether they are diphtheria microbes. As soon as the microbes have been examined the health department reports to the physician what kinds were found.

Or if a physician has a patient sick with a fever, he can send a little sample of the patient's blood to the health department, and it will be examined to find out whether it contains the microbe of typhoid fever.

Or if a physician has a patient who has a cough and is raising sputum, he may think that possibly his patient has tuberculosis. He can send some of the sputum to the health department, where it will be examined to see whether it contains the microbes of tuberculosis. The health department also makes examinations for other diseases. These examinations are a great help in this way to sick people and to physicians, for many physicians have not the time or instruments necessary to make these examinations for themselves.

Then, too, the health department often examines in its laboratory the city water, that is, the water supplied to the people for drinking. It does this to make sure that the water is not polluted and does not contain the microbes of diseases.

Milk is also examined at the laboratory. The health department will buy milk from different milkmen and examine it to see that it is clean and that it has been carefully handled. All milk contains some microbes, but these are usually harmless. If the milk contains a great many microbes, the health department knows that it has not been properly produced and handled.

How the health department sees that only good milk is sold. — The milk which is sold in cities comes from farms

in the country. Many health departments have men who visit these farms to see whether the cows are healthy and the milk is kept clean and carefully handled. The dairies in the cities where the milk from the farms is brought and bottled are also inspected to make sure that the milk is kept clean. In many cities the men who work at these dairies are examined to see that they do not have diseases that might be spread by the milk. Then, as we said before, in many cities samples of milk are got from milk wagons, as it is about to be delivered to houses, and these samples are examined in the laboratory to make sure that only good, safe milk is being sold.

How the health department watches over our food. — We learned in a previous chapter how some disease microbes may get on the food we eat and how the microbes may be carried to the food by flies or may get into it if it is handled by persons who have certain diseases. In many cities the health department has men visit the places where food is handled and sold to see that flies are not allowed to get on it and that the people handling it have no disease of which the microbes might be carried to others. Among the places inspected are fruit stands, bakeries, grocery stores, candy stores, and meat markets. Hotels and restaurants are also inspected for the same purpose.

Who pays the expenses of the health department. — The health department is maintained by the people to do all these things for them. A city health department costs a great deal of money, for all those who work for it have to be paid. The money to pay them comes from the taxes which people pay each year. Some cities have health departments which do all the things of which we have told. Others have smaller health departments which

do only some of these things. In cities where people want to be protected from disease as much as possible, they have large, well managed health departments. People should know what their health department does, because it is their money that pays for the work.

Questions

1. What can the health department do for babies?
2. What is an "infant welfare station"?
3. What does the health department do to help the physicians? What is done at a health department laboratory? Do you think every health department should have a laboratory? Why?
4. What can the health department do to prevent disease being spread by milk?
5. Why should cows on dairy farms be inspected?
6. Why should only farmers who keep their stables and cows clean be allowed to sell milk?
7. Why should sick people not be allowed to milk cows or handle milk which is to be sold to others?
8. Should the health department inspect the dairies in cities where milk is bottled and sold? Why?
9. Should the health department inspect places where food is handled and sold? Why?
10. What kinds of food need to be kept clean and away from flies?
11. Why should flies be kept away from bread, fruits, meats and other foods?
12. Is there any danger in allowing people who have communicable diseases to handle foods? Why?
13. Why should the health department inspect restaurants and hotels?
14. Does it cost much for a city to have a good health department? Who pays the money it requires to maintain the health department?
15. Do you think every city should have a good health department? Why?

CHAPTER XXXVIII

The State Department of Health and What It Does

In a preceding chapter we told of the work of the city health officer and health department. But only a part of the people live in cities. Many people live in small towns and in the country. People travel from one place to another and may carry disease. The food and milk used by the people of the city are produced on farms in the country. To protect the health of the people there must be a health department which can prevent the spread of disease in the country and small town and from country and town to cities and from one city to another. For this purpose state health departments have been created.

What state departments of health are. — Like the city health department, a state health department usually consists of a board of health and a health officer. The board of health consists of several members, mostly physicians, but usually with a lawyer and engineer among its members. This board plans the work to be done and decides all important matters. The health officer sees that the work planned by the board is carried out. The members of the board and the health officer are usually appointed by the governor of the state. The members of the board receive little or no pay, as they are usually engaged at their own work and spend but a small part of their time in the work of the health department. The health officer spends all his time in the work of the health department

and is paid a salary. The health officer has many men working under him doing the many things necessary to protect the health of the people.

Work of the state health department. — While the city health department has power to make regulations to be carried out only in the city, the state health department makes regulations to be carried out in all parts of the state. The city health department can control disease only in the city, but the state health department can control disease everywhere in the state. The state health department knows what diseases are present in the state and where most of the cases are. When diseases become epidemic in any place in the state, it may send men to help the city or town health officers at the place. It sends men, if necessary, to aid in controlling the disease and to protect the people. In many states the state health department inspects all the farms where milk is produced for sale, to see that the cows are healthy and the stables kept clean. In some states it controls the water supplies of towns and cities, to see that the people have pure water to drink. The state health department furnishes help wherever it is needed to protect people's health. In most states it also does all it can to teach people how to keep healthy.

State health laws and regulations. — Every state has many laws the purpose of which is to protect the health of the people, for the health of the people is most important to any state. People who are not healthy are seldom happy. They cannot do good work and often cannot work at all. A man who is sick cannot earn the money his family needs. A woman who is sick has difficulty being as good a mother as one who is well. Every attack

of sickness does some injury to the body machine. It may be but slight injury, or it may be great. It may be injury to the heart, or the kidneys, or the stomach, or the brain. The person who has been sick may feel perfectly well again, but some injury has been done to the body machine, and the body machine is not quite so good as it was before. In this way attacks of serious illness shorten our lives, even though we recover from them. People wish to be strong and healthy and the state wants its people strong, healthy and happy. This is the purpose of state health laws, and this is the reason that there are health officers and health departments.

The prevalence of disease. — One of the things usually required by the law of the state is that physicians must report to the health officer whenever they have a patient who has a disease which can be spread from one person to another. The most common of these diseases are diphtheria, leprosy, malaria, measles, meningitis, mumps, pneumonia, scarlet fever, smallpox, tuberculosis, typhoid fever, and whooping cough.

The physician sends his reports of cases to the city or town health officer so that the health officer will know what kinds of communicable diseases are present in the city or town, how many cases there are, and where they are. If the health officer does not know what diseases are present, and how many cases there are, and where they are, he cannot do much to prevent the spread of the diseases, nor will he know when an epidemic is developing or when special precautions need to be taken.

The town and city health officers report to the state health department the number of cases of the communicable diseases in each of their towns or cities. In some

states they make these reports daily, in some states they report once a week. In this way the state health department knows at all times just how many cases of these diseases there are in each town or city of the state, where the diseases are increasing and where there are epidemics. It knows when the town or city health officers need help in controlling the diseases and can send whatever help is necessary.

Questions

1. Why are state health departments necessary?
2. In what way do state health departments resemble the city health departments?
3. What do the state health departments do?
4. How do they help city health departments?
5. What do they do for people in the country and small towns?
6. How do state health departments learn what diseases are present in their states and where they are spreading?
7. Do you think the work of the state health department is important? Why?

CHAPTER XXXIX

The United States Public Health Service

The cities have health departments to look after the health of the people living in cities. Each state has a health department to look after the health interests of all the people in the state and to do the things city health departments cannot do. The national government at Washington has a health service, called the United States Public Health Service, to do the things which only the national government can do to protect the health of all the people.

The work of the United States Public Health Service. — The United States Public Health Service works with and assists the state health departments whenever they need help. It keeps records of the prevalence of disease throughout the country, so that it knows just where diseases are most prevalent and where they are spreading. It prevents the bringing in of disease from foreign countries and the spread of disease from one state to another. When dangerous epidemics occur, it sends its experts to suppress them. It maintains a laboratory, called the Hygienic Laboratory, where its officers are constantly studying diseases, their causes, and how to prevent them.

How it watches the occurrence of disease. — We learned in a previous chapter how the physicians report to the city health officers the cases of communicable disease among their patients, and how the city health officers

forward the reports to the state health department, so that the state health officer will know what diseases are occurring in the state and where the cases are.

The state and city health departments forward reports of the cases to the National Public Health Service at Washington. The city health departments report to Washington each week by mail the number of cases occurring in the cities. The state health departments report each week by telegraph the number of cases occurring in the states. In this way the Public Health Service knows at all times the prevalence of disease throughout the entire country. It publishes each week a bulletin telling how many cases of communicable diseases have been reported in all the cities and states and sends copies to the health departments of the cities and states, so that they, too, know where dangerous diseases are present and where they are spreading throughout the whole country.

How it helps state health departments. — Whenever a state health department needs help, the Public Health Service will send specially trained men to work with it. Or whenever a disease becomes epidemic and is spreading from one state to another, it sends its officers to aid in controlling the epidemic and prevent its spread. Whenever plague or yellow fever or any specially dangerous disease has become epidemic, it sends it officers to help control the disease and stop its spread.

Studies causes of disease. — While medical men have found the causes of many diseases and know how they are spread and what must be done to prevent them, there are still diseases of which we do not yet know the cause or just how they are communicated from one person to another. The Public Health Service has many trained men

who are busy studying these diseases. Some of these men work at the Hygienic Laboratory at Washington. Others are working in various parts of the country wherever the disease they are studying is most prevalent.

Pellagra is a disease which has been common in the southern part of the United States for several years. The disease has been present in southern Europe and northern Africa for a long time. Yet we did not know what caused it. Some thought it was due to eating spoiled corn. Others thought it was due to a microbe which grew on corn. The Public Health Service undertook to find out what caused the disease. It sent its officers to those parts of the country where there were the greatest number of cases. They found that the disease was due to people not eating all the kinds of food their bodies needed, and that people who drank milk and ate fresh vegetables and eggs did not have the disease.

This Service has men studying leprosy, how it is spread and how it can be cured. These studies are carried on in the Hawaiian Islands, where there are many cases of the disease, and also at a hospital for lepers in Louisiana.

What is done to prevent diseases from being brought to the United States from foreign countries. — There is yellow fever in certain parts of Central and South America. Cholera and plague are present in parts of Asia. Typhus fever is present in eastern and southern Europe. These diseases are seldom present in the United States, although ships are constantly coming to our country from places where they are present. Whenever a ship comes from a foreign country, before it is allowed to come to the dock and let off any of its passengers, an officer of the Public Health Service goes aboard and examines the passengers

and members of the crew to make sure that none of them is sick with any of these dangerous diseases. If there are cases of disease aboard, the sick are taken care of and the ship is not allowed to let the passengers and crew land until there is no longer danger of spreading the disease.

Examination of immigrants. — Each year there are several hundred thousand people who come to the United States from foreign countries. Most of them come here to live. They are called immigrants. When they arrive in this country, they are examined by physicians of the Public Health Service to find whether they have diseases which they might spread to others. If an immigrant has a disease which can be cured in a short time, he is kept in a hospital until he is well. If the disease is one which will last a long time, the immigrant is sent back to the country from which he came.

The Public Health Service is always studying how diseases can be prevented and what things can be done to make the people of our country healthier. It is at all times ready to coöperate with and help city and state departments of health, when such help is needed to protect the health of the people.

Questions

1. What does the United States Public Health Service do?
2. How does it learn what dangerous diseases are present in our country and where they are spreading?
3. What does it do to help city and state health departments?
4. What can you say about how the United States Public Health Service is constantly studying diseases and how to prevent them?
5. How does it prevent dangerous diseases from being brought to this country by ships from foreign countries?

CHAPTER XL

Why Births and Deaths Are Recorded

Recording of births. — Almost everywhere in the United States, the law requires that whenever a baby is born the fact shall be recorded with an official known as a registrar. The principal facts which usually have to be recorded are: the name of the child, whether boy or girl, the date and place of birth, and the names of the parents.

It is very important that each child's birth be recorded in this way. A child may want to go to school, and the teacher may think the child is not old enough. If the child's birth has been recorded, the parents can show just how old the child is.

In many states boys and girls are not allowed to go to work until they have reached a certain age, usually 14 or 16 years. It may be necessary for a boy to go to work to earn money. If his birth was recorded, he can prove whether he is old enough. If his birth was not recorded, he may not be able to do this.

In many states young men and women cannot get married without their parents' consent unless they have reached a certain age. For this reason men and women often want to prove how old they are. If their births have not been recorded it may be very difficult.

A boy may want to enlist in the army or navy. He may want to show that he is old enough. His birth record will show just how old he is.

A person may want to vote. One cannot vote until one

is twenty-one years old. The sure way to prove whether one is old enough to vote is by the birth record.

In some places people do not understand the great importance to the child of having its birth officially recorded, and unfortunately the births of many children have not been recorded. They will have difficulty if they ever want to prove how old they are. They may even at some time have difficulty proving who their father and mother were or that they were born in the United States and are therefore citizens of this country.

Recording of deaths. — Deaths of people are also recorded with the registrar. Usually the law will not permit a body to be buried in a cemetery until the death has been properly recorded. The record of the death shows the name and age of the person and the cause of death.

If the person who dies left money or property, the record of the death is often necessary so that the children or other heirs may get the property. Or if the person who died had life insurance, the record of death may be necessary so that the person to whom the insurance money should go may get it.

The records of deaths also show what things are causing the deaths of the people, how many are being killed by automobiles, and how many are being killed by typhoid fever, tuberculosis, measles, and other diseases. These are things we must know if we want to protect our lives against the things which destroy us.

Questions

1. Why is it important that the birth of every baby be officially recorded?
2. Tell some of the advantages of having one's birth recorded.
3. Why is it important that deaths be officially recorded?

APPENDIX

By Belva E. Cuzzort

Directions for Keeping Clean

The Bath

Take a bath in cold, warm or hot water as it suits you best.

Take care to find which does suit you best.

You should feel warm and good after a bath whether it has been a cold, warm or hot one. A good rubbing with a towel brings glow and warmth if your bath has been the right kind for you.

It is good for the skin to be quite warm, like a hot towel at times, and cold at times. The changes train it and make it better able to do its work. Air and sunshine do it good also.

The bath, except when taken to clean the body, should not take more than two or three minutes. I it is dragged out for several minutes, especially in a room that is too cold, the body will be chilled and that is bad.

A bath of warm water and soap to clean the body should be taken twice a week or oftener. Clean underclothing is needed at least once a week.

To Keep Scalp and Hair Healthy

Keep the whole body healthy. Do not stay fatigued.

Exercise the scalp every day by brushing the hair well with a brush of good bristles. Take 60 to 75 strokes.

Use your own comb and brush. Keep comb and brush clean. Aim to have glossy clean hair.

To Care for the Nails

Wash in lathery warm suds. Use a brush to clean the edges. Do not run metal points under the edges. This makes them rough and dirt collects. Use a soft orange wood stick or other soft stick with or without cotton.

Do not ever bite the nails. File them. Use nail scissors to cut hang nails away. Give the nails good care and they will show it no matter what your work is.

Do not handle food with unclean finger nails.

How to Care for the Hands and Face

Too frequent washing the face in very warm water is not best for it. The hands should be washed in warm water and soap oftener than the face because they collect more dirt. The face and neck and ears should be washed with a soft cloth, using warm water and soap once a day. It may be rinsed in cold water often.

It is such care as this and good health that give the skin a clear smooth appearance, and a good glow.

Pasteurizing Milk at Home

Three Ways

First. Bring the water in the larger vessel to a boiling point, take the vessel off the fire and put in it a smaller vessel that contains the milk. Let it stand on table or cool part of stove, 20 or 25 minutes. Be sure that the cover fits tight. At the end of the time put the milk in cool vessel, well covered, and cool *at once.*

Second. Another way is to put the vessel holding the milk in the larger vessel containing the water before the water is heated. Heat, bringing milk to 145° (Fahrenheit). Then take it off the fire, wrap a heavy toweling kept for the purpose around the entire boiler and so keep the heat in for 20 to 25 minutes. Again put away to cool.

Third. By this plan, the milk is put into bottles first. The bottle mouths are covered with the paper covers made for the

purpose. Set them in a pail that has in it a false bottom into which the bottles fit. Punch a hole into the cover of one bottle for the thermometer. Fill the pail with water nearly to the level of the milk, and heat until the milk shows 145 to 150 degrees F. Then take the bottles from the pail, put a new cover on the bottle that held the thermometer, cover with a towel, and allow to stand 20 to 25 minutes. Then put in a cool place.

By the third plan, the milk is kept covered until time to use it. For sick people and for small children who should have milk as free from bacteria as possible, this is important.

Pasteurizing Milk for the Baby

Any of the three ways may be used but the third plan of heating in the baby's bottle, keeps the milk from the air and from being poured from vessel to vessel. Keep two bottles ready, so if one breaks, there is another at hand.

Caution in Pasteurizing:

1. Do not overheat. This cooks the milk.

2. Do not pour the Pasteurized milk in vessels that have not been scalded just before using. This admits germs and it is to destroy germs and bacteria that the milk is Pasteurized.

The Iceless Refrigerator

Construction. — A wooden frame is made with dimensions 42 by 16 by 14 inches and covered with screen wire, preferably the rustless type, which costs little more than the ordinary kind. The door is made to fit closely and is mounted on brass hinges, and can be fastened with a wooden latch. The bottom is fitted solid, but the top should be covered with screen wire. Adjustable shelves can be made of solid wood or strips, or sheets of galvanized metal. Shelves made of poultry netting on light wooden frames, as shown in the illustration, are probably the most desirable. These shelves rest on side braces placed at desired intervals. A bread baking pan, 14 by 16 inches, is placed on the top and the frame rests in a 17 by 18 inch pan.

All the woodwork, the shelves, and the pans should receive two coats of white paint and one or two coats of white enamel. This makes a very attractive surface and one that can be easily kept clean. The screen wire also may receive coats of enamel, which will prevent it from rusting.

A cover of canton flannel, burlap, or duck is made to fit the frame. Put the smooth side out if canton flannel is used. It will require about three yards of material. This cover is buttoned around the top of the frame and down the

FRAMEWORK OF ICELESS REFRIGERATOR

COMPLETED ICELESS REFRIGERATOR

Courtesy U. S. Department of Agriculture

side on which the door is not hinged, using buggy hooks and eyes or large headed tacks and eyelets worked in the material. On the front side arrange the hooks on the top of the door instead of on the frame and also fasten the cover down the latch side of the door, allowing a wide hem of the material to overlap the place where the door closes. The door can then be opened without unbuttoning the cover. The button of the cover should extend down into the lower pan. Four double strips, which taper to 8 or 10 inches in width, are sewed to the upper part of the cover. These strips form wicks that dip over into the upper pan.

The dimensions given make a refrigerator of very convenient size for household use, but it may be made higher and bigger.

CARE. — The refrigerator should be regularly cleaned and sunned. If the framework, shelves, and pans are white enameled they can more easily be kept in a sanitary condition. It is well to have two covers, so that a fresh one can be used each week and the soiled one washed and sunned.

Digestion of Foods

Digestion begins with the work of glands. Glands are in the lining of the mouth, stomach and small intestine. Besides, there are the two large glands, pancreas and liver, that send their juices into the small intestine.

In the mouth are the salivary glands, secreting the saliva. This does more than moisten the food. It starts the digestion of the starches, and changes some sugars into the kind the body can use. It is a serious matter for some foods to be swallowed without being mixed with saliva or for the starch in foods to be left half raw so that saliva does not act on it well.

The gastric juice which the gastric glands of the stomach walls secrete has pepsin and acid in it. The lean of meat, and proteid of other foods are digested by it. Besides the acid destroys bacteria that would otherwise be harmful to good digestion. This juice is not secreted evenly all day long, but there is more of it when we eat. The food in the stomach is mixed with the gastric juice by the action of muscles in the stomach walls.

The stomach has its peculiar way of holding the food for a time, and then of letting it pass into the small intestine at just the right time. If the food has not been well chewed and there are big pieces the stomach's work is made harder.

Each digestive organ has its own work. In the small intestine there are intestinal juices, besides the pancreatic juice and the bile from the liver. Here digestion is completed. The walls of the intestine are of a velvet-like texture. They absorb the food.

Digestion of a hearty meal cannot go on when the blood is in the muscles or brain. There is not enough blood in the body to provide for all kinds of work at once. If there were, it would take a bigger heart to pump it and larger lungs to furnish it with oxygen.

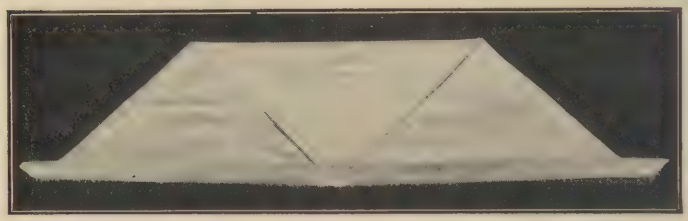
Taking time to eat a meal, resting after strenuous exercise, before beginning to eat, and giving the digestive organs time for their work after the meal, are necessary. The muscle walls and the glands used in digestion need food that only the blood can bring.

First Aid Information and Practice

Bandages [1]

Make of gauze, unbleached muslin, or cheese cloth. If an emergency arises and no bandages are made use fresh laundered pillow slips or handkerchiefs. A perfectly safe bandage is one that has been made clean, and put into a paper slip so that dust and fingers do not reach it.

The triangular bandage is made from a square having a side not less than 34 to 38 inches in length. The square is cut diagonally across.



Courtesy Bureau of Mines

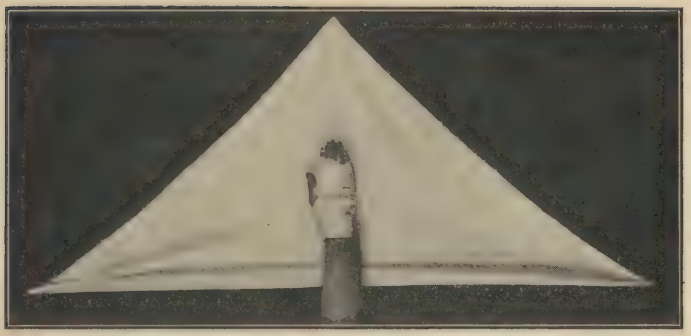
(1) The Narrow Folding Started

Courtesy Bureau of Mines

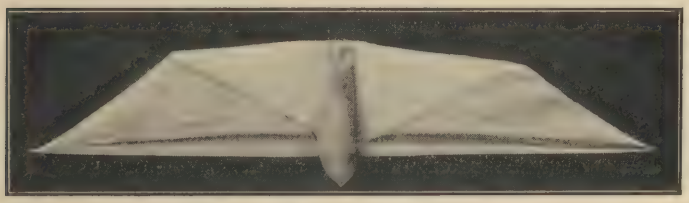
(2) The Same with Folding Completed

Note how neatly and evenly it is done.

[1] See *First Aid Book* of American Red Cross for further information about bandages.



(1) Use of Triangular Bandage



(2) Use of Triangular Bandage

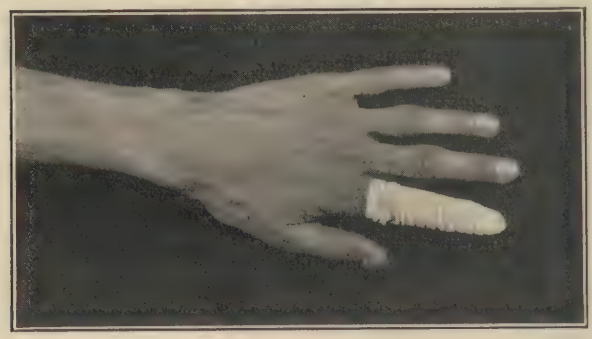
Courtesy Bureau of Mines

(1) A Roller Bandage of Cheese Cloth

Notice that only the edges are touched in holding it.

(2) The Beginning in Using a Narrow Roller Bandage on Finger

Notice again that only the edges of the bandage are touched. (A little difficult.)



Courtesy Bureau of Mines

(3) A Finger Bandaged

Another way of using roller bandage on the finger. (Requires care to do properly.)

The roller bandage is made of narrow strips of material, usually cheese cloth or gauze rolled so that it is kept smooth and straight. These rolls sealed in paper packages may usually be bought. It is narrow or wide, depending on whether it is used on the finger, arm, leg, chest, or abdomen. To make this bandage and keep it clean, one must follow directions such as a doctor or nurse may give. Bandages not safe may, if put on a wound, cause blood poisoning. The illustrations on page 222 show the roller bandage and a few of its uses.

From a piece of roller bandage two or three feet long a four-tailed bandage can be made by folding the bandage the long way and splitting this fold, leaving a space at center four or five inches long unsplit.

Courtesy Bureau of Mines

USE OF THE FOUR-TAILED BANDAGE

Wounds

Do not put your hands on a wound. If the wound is not deep so there is no danger of germs being left alive and washed farther in, warm water that has been boiled or a solution of half water and half peroxide of hydrogen may be used to wash the wound. Tincture of iodine painted on a fresh wound is of the greatest help in destroying germs. It may be put on with a torn bit of a clean handkerchief soaked in it, for it destroys the germs on the handkerchief as well as in the wound. It should touch every part. The Red Cross First Aid Manual warns against using it near the eye and says it is better not to wash the wound before using the iodine. You see how valuable it is to know what to do and to have bandages ready in case of emergency.

Stopping Bleeding from an Artery

Tie bandage between the hurt part and the heart. The blood from an artery is bright red. It comes out in spurts as the heart beats. The cutting of a big artery may cause a person to bleed to death. Stop the bleeding before treating the wound. Do both as soon as possible.

In order to stop the bleeding in the safest and best way, learn to make a tourniquet.

Courtesy Bureau of Mines

TOURNIQUET BANDAGE FOR BLEEDING

Place a smooth round stone in a cloth. Lay this over the artery on the side of the wound next to the heart. Take a bandage and pass it over the stone and around the limb. Tie the bandage in a knot but far enough from the limb that a stick will pass through. Twist the stick until the bleeding stops.

Stopping Bleeding from a Vein

The blood from the vein is dark and flows evenly and does not spurt. Tie the limb on the side of the wound away from the heart.

Do not tie so tight that the end of the limb will have no circulation of blood at all, just tight enough to stop bleeding.

Bleeding of Small Blood Vessels — The Capillaries

This blood flows slowly and the blood will soon clot enough to stop it. We would bleed to death if blood did not clot.

Treat the wounds no matter whether artery, vein, or capillaries are injured as described on the preceding page.

BANDAGE FOR BURN ON CHEST

Courtesy Bureau of Mines

SHOWING HOW BANDAGE IS FASTENED

Burns

Burns should, as soon as possible, be protected from air. Where the skin is broken, special care should be taken to keep germs away. A weak picric acid solution is good to use on a burn. If this is not at hand, baking soda will do. A physician should be called if the burn is on a main part of the body, for it may be serious even when it does not seem so. Proper bandaging is the best way to protect a burn from the air. See illustrations above.

Drowning

After the person is rescued at once get water out of lungs and stomach. Lay him over a log or over another person who is on hands and knees or lift him by clasping your own hands under

Courtesy Bureau of Mines

ARTIFICIAL RESPIRATION — (1) AIR GOING INTO THE LUNGS

Courtesy Bureau of Mines

ARTIFICIAL RESPIRATION — (2) AIR GOING OUT OF THE LUNGS

his stomach as you stand at his back. This lets the water run out of his lungs. Next put him in a position where you can give artificial respiration. Notice in the photographs below the man is lying on his face, though his head is on his elbow and turned so he can get air. The other arm is thrown out.

To perform artificial respiration do this: Place yourself as the man in the picture on page 226. Put your hands a few inches above the small of the back of the rescued person — the fingers pointing slightly up and toward the front. Press with all your force. Do not bend your elbows. Let the weight of your body from your knees up rest on your hands. This forces air out of the lungs. Then take your weight away — leaving your hands in position. The chest becomes larger and air goes to the lungs. Do not take your hands away as you do this. Get a rhythmic motion. You should press about every four seconds. It takes practice to learn to perform artificial respiration.

A First-Aid Kit

If your school has a first-aid cabinet that has been purchased with supplies find what supplies are there that you know how to use.

If you collect your own supplies, you should have the following because your first-aid knowledge enables you to use these.

Soap, towel, to use in washing your hands. Also solution of half peroxide of hydrogen and half water in case you can not have water that has been boiled to wash hands in.

Roller bandages of different width — in sealed paper packages. Triangular bandages in wrapped packages. Absorbent cotton.

Lugol's solution of iodine.

Scissors, safety pins.

Can of "canned heat" and cup in which water can be heated. Box of safety matches.

Tea, coffee for stimulants. Mustard to use in making a person vomit.

Aromatic spirits of ammonia for stimulant.

Picric acid, and baking soda for burns.

Stone and stick for tourniquet bandage.

In addition to the kit you should know the telephone number of the fire department if your town has one. If it does not have you should know the quickest way to attach small hose to the house water supply. You should know the telephone number of the hospital if there is one near you and of your doctor and another doctor in case you cannot get your own at once. You should also observe who of your neighbors know how to treat accidents in emergency. Information, common sense and the first-aid kit should grow large together in first aid.

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